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Rubber Research Scheme

(Ceylon).

Ninth Annual Report

PROCEEDINGS DURING THE YEAR

1930.

To be presented at the Final General Meeting of Subscribers.

March 26, 1931.

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Rubber Research Scheme (Ceylon).

Peradeniya,
24th February, 1931.

NOTICE.

Notice is hereby given that an Extraordinary General Meeting of the Rubber Research Scheme (Ceylon) will be held in the ball-room of the Grand Oriental Hotel, Colombo, on 26th. March, 1931, at 11 a. m. for the following purposes:—

1. To receive and consider the report of the Rubber Research Scheme (Ceylon) for the year ended December 31, 1930, and the Statement of Accounts and Balance Sheet as at July 31, 1930,and at December 31, 1930.

2. To receive and consider the reports of the technical officers of the Rubber Research Scheme.

3. To receive and consider the report of the London Advisory Committee.

4. (*a*). To confirm the following resolution which was unanimously adopted by the Executive Committee at their final meeting held on October 24, 1930:—

   "That the entire assets, liabilities and staff of the old Rubber Research Scheme be offered to the Board of Management of the new Rubber Research Scheme, with effect from August 1, 1930, the date on which the Rubber Research Ordinance came into operation."

   (*b*). To sanction the assignment of the lease of the land at Nivitigalakele entered into by the Crown with the erstwhile Rubber Research Scheme (Ceylon), to the Board of Management of the Rubber Research Scheme as constituted under Ordinance No. 10 of 1930.

It is requested that all Subscribers to the old Rubber Research Scheme of Ceylon should, if possible, be present at this, the last meeting of the former Scheme.

By Order.

J. I. GNANAMUTTU,

Secretary,

Board of Management,

Rubber Research Scheme (Ceylon).

Committees of the Rubber Research Scheme
up to August 1, 1930.

EXECUTIVE COMMITTEE:

THE HON'BLE, Dr. W. YOUNGMAN, D.Sc., Ph.D. (*Chairman*).
MR. C. W. BICKMORE, (*Actg. Colonial Treasurer*).
THE HON'BLE, MR. C. E. HAWES.
MR. D. S. CAMERON (*on leave*)
„ J. M. MACKENZIE, *Acting*.
„ D. DAVIDSON, (*on leave*)
„ C. GILLIAT, *Acting*.
„ C. E. A. DIAS, J.P. (*on leave*)
„ W. A. PERERA, *Acting*.

THE CHAIRMAN, PLANTERS' ASSOCIATION OF CEYLON.
MR. ALLEN COOMBE, (*on leave*)
„ A. H. HEALY *Acting*.
„ J. FARLEY ELFORD.
„ A. S. COLLETT.
„ G. B. FOOTE, (*on leave*)
„ J. D. HOARE, *Acting*.
„ J. A. D. FINCH NOYES.
„ F. F. ROE.
LT-COL. T. Y. WRIGHT.
MR. J. I. GNANAMUTTU (*Secretary*).

TECHNICAL COMMITTEE:

THE HON'BLE, DR. W. YOUNGMAN, Director of Agriculture (*Chairman*).
DR. J. C. HUTSON, Entomologist, Department of Agriculture (*on leave*).
MR. F. P. JEPSON, Acting Entomologist, Department of Agriculture, (*Acting*).
„ A. W. R. JOACHIM, Chemist, Department of Agriculture.
„ M. PARK, Acting Mycologist, Department of Agriculture.
„ L. LORD, Economic Botanist, Department of Agriculture (*on leave*).

MR. T. H. HOLAND, Manager, Experiment Station, Peradeniya, (*acting for Mr. Lord*).
THE HON'BLE, MR. J. W. OLDFIELD, (*on leave*)
MR. H. W. ROY BERTRAND, F.L.S.
„ C. E. A. DIAS, J.P. (*on leave*).
„ L. P. GAPP.
„ T. E. H. O'BRIEN, Chemist of Scheme.
„ R. A. TAYLOR, Physiological Botanist of Scheme.
„ R. K. S. MURRAY, Mycologist of Scheme.
„ J. I. GNANAMUTTU (*Secretary*).

Board of Management of the Rubber Research Scheme (Ceylon).

As Constituted under Ordinance No. 10 of 1930.
THE DIRECTOR OF AGRICULTURE, (*Chairman*),
THE ASSISTANT COLONIAL TREASURER.

Unofficial Members of the Legislative Council, Nominated by His Excellency the Governor.

THE HON'BLE, MR. C. E. HAWES, | THE HON'BLE, MR. H. R. FREEMAN,
THE HON'BLE, MR. A. F. MOLAMURE.

Nominated by the Ceylon Estates Proprietory Association.

COLONEL T. Y. WRIGHT, | MR. J. A. D. FINCH NOYES.

Nominated by the Planters' Association of Ceylon.

MR. J. FARLEY ELFORD, | MR. F. H. GRIFFITH.

Nominated by the Rubber Growers' Association (Incorporated).

MR. A. S. COLLETT, | MR. J. D. HOARE.

Nominated by the Low-Country Products Association.

THE HON'BLE, MR. C. H. Z. FERNANDO, | MR. C. E. A. DIAS, J.P.
MR. D. C. SENANAYAKE, | „ A. E. DE SILVA.

Nominated by His Excellency the Governor to represent Small-Holders.

MR. C. A. PERERA, | MR. B. F. DE SILVA.

LONDON ADVISORY COMMITTEE:

Representatives of the Rubber Growers' Association ...	MR. P. J. BURGESS, M.A., F.C.S., (*Chairman*).* „ H. ERIC MILLER. „ HERBERT WRIGHT.*
Representatives of Ceylon Planting Interests ...	SIR STANLEY BOIS. MR. G. H. MASEFIELD.*
Representatives of Rubber Manufacturing Companies...	MR. W. C. SMITH, F.C.S., F.I.R.I.* „ W. A. WILLIAMS, F.I.C.* DR. D. F. TWISS, F.I.C., F.I.R.I.*
Representative of the Research Association of British Rubber & Tyre Manufacturers	LT-COL. J. SEALY CLARKE.*
Representatives of Imperial Institute	LT-GEN. SIR WILLIAM FURSE, K.C.B.,D.S.O.* LT-COL. SIR DAVID PRAIN, C.M.G.,C.I.E., F.R.S.*
Botanists	PROFESSOR V H. BLACKMAN, M.A.D.Sc., F.R.S.* MR. H. N. RIDLEY, C.M.G., F.R.S.* „ F. A STOCKDALE, C.B.E., M.A., F.L.S.* „ J. MITCHELL, A.R.C. Sc.*
Secretary	MR. J. A. NELSON, B.Sc., F.S.S.*

*Members of Technical Sub-Committee.

Scientific Staff:

LONDON.

MR. G. MARTIN, B.Sc., A.I.C. F.I.R.I., Chemist, (Superintendent).
MR. W. S. DAVEY, B.Sc., A.I.C., F.I.R.I., Chemist.

MR. F. L. ELLIOTT, F.I.C., F.I.R.I. Chemist.
„ L. L. STEWART, Laboratory Assistant.

CEYLON.

MR. T. E. H. O'BRIEN, M.Sc., A.I.C., Chemist, (Chief Technical Officer.)

MR R. K. S. MURRAY, A. R. C.Sc., Mycologist.
„ W. I. PIERIS, B.A., (Cantab) Agr. Assistant.

VACANT.—Physiological Botanist.

Auditors:—DUNCUM, WATKINS, FORD & CO., COLOMBO & COLONIAL AUDITOR.
Offices:—RUBBER RESEARCH SCHEME, PERADENIYA. SECRETARY, J. I. GNANAMUTTU.
Bankers:—NATIONAL BANK OF INDIA, LTD.
Research Laboratories:—CULLODEN ESTATE, NEBODA.
Experiment Station:—Nivitigalakela, Matugama.

NINTH ANNUAL REPORT OF THE RUBBER RESEARCH SCHEME (CEYLON).

Ordinance No. 10 of 1930, which provided for the establishment of a Rubber Research Scheme and for the incorporation of the Board of Management thereof, received the assent of His Excellency the Governor on August 1, 1930. The nominations to the Board, however, were not completed until November 24, and the Board met for the first time on December 5.

The Board considered the following resolution which had been unanimously carried at a meeting of the Executive Committee of the old Scheme held on October 24, 1930:—

> "That the entire assets, liabilities and staff of the old Rubber Research Scheme be offered to the Board of Management of the new Rubber Research Scheme with effect from August 1, 1930, the date on which the Rubber Research Ordinance came into operation."

This offer was subject to confirmation by a meeting of subscribers to the old Scheme. The Board resolved unanimously that the assets, liabilities and staff of the old Rubber Research Scheme be taken over by the new Board of Management.

The Scheme continued to be financed from the funds of the old organization up to the end of December, 1930. For that reason, a report covering the whole of the year 1930, as was done in past years, is presented to the subscribers.

Membership.—A complete list of members who subscribed for the period January to July, 1930, is given in Appendix A to this report. There were 104 Rubber Growers' Association members, and 108 Rubber Research Scheme members, making a total of 212 as against 216 members at the end of 1929.

Subscriptions.—The subscriptions for the seven months amounted to Rs. 22,037/15, as compared with Rs. 20,738/33 received for the corresponding period of 1929. The Rubber Growers' Association paid into the London account £. 1,166.13.4, being the proportion of its annual contribution of £. 2,000.

Government Grant.—Rs. 39,375, being seven-twelfths of the annual grant of Rs. 67,500, was received and credited up to July.

Cess Collection.—The cess provided for under the Ordinance was levied as from August 1, and the amounts realised were as follows:—

For August	...	Rs.	17,203-01
,, September	...	,,	21,950-20
,, October	...	,,	21,654-01
,, November	...	,,	16,837-20
,, December	...	,,	14,959-77
Total Rs.	...		92,604-19

Executive Committee.—Dr. W. Small continued to act as Chairman until the arrival of the permanent Director of Agriculture, Dr. W. Youngman, who assumed charge on March 17, 1930.

The following were the changes in the personnel of the Executive Committee:—

Mr. Clifford Figg resigned in March, 1930, and Mr. A. S. Collett succeeded him.

Mr. J. A. D. Finch Noyes succeeded Mr. A. Hollingworth who resigned his seat in August, 1929.

Mr. Allen Coombe left on home leave in June, 1930, and Mr. A. H. Healey acted for him.

Mr. C. E. A. Dias was away in Europe from March 1930, and Mr. A. Wilmot Perera acted for him.

Mr. G. B. Foote left on home leave in April, 1930, and Mr. J. D. Hoare acted for him.

Mr. D. Davidson left on home leave in May, 1930, and Mr. C. Gilliat acted for him.

Mr. D. S. Cameron left on home leave in May, 1930, and Mr. J. M. Mackenzie acted for him.

Five meetings of the Executive Committee were held, the dates being March 14, April 25, June 13, July 26 and October 24. Printed copies of the minutes of these meetings were circulated to all members of the Rubber Research Scheme.

London Advisory Committee.—The Committee held four meetings during the year, on January 31, March 28, June 27, and October 24. Copies of the minutes of these meetings were issued to the members of the Executive Committee.

The annual report of the London Advisory Committee and reports of the technical officers working at the Imperial Institute, London, are attached (pages 33 to 40).

Technical Sub-Committee (London).—Meetings of this Sub-Committee were held on January 31, March 28, June 27 and October 24. Copies of the minutes of these meetings were circulated to the members of the Technical Committee in Ceylon.

Technical Committee (Ceylon).—Meetings were held on March 14 and May 28. Copies of the minutes of these meetings were circulated to the members of all the Committees of the Scheme.

Director of Research.—This post remained vacant during the year, awaiting consideration by the new Board of Management, which resolved at its first meeting to advertise with a view to securing the best man available and to leave the salary open.

Chemist.—Mr. T. E. H. O'Brien, Chemist, was appointed to the temporary post of Chief Technical Officer as from January 1. His agreement with the Scheme terminated on December 19, and the Board of Management, at its first meeting, decided to re-engage him for a further period of service.

Secretary.—The secondment of Mr. J. I. Gnanamuttu to this post was, at the desire of the Executive Committee, extended by Government for a further period of one year.

Physiological Botanist.—Mr. R. A. Taylor resigned his post and left the Research Scheme on August 19. The Board decided to advertise this post and to invite applicants to state the salary required.

Geneticist—The Board also resolved to appoint a Geneticist, to be selected in the same way as the Director of Research and the Physiological Botanist.

Agricultural Assistant.—Upon the resignation of Mr. Taylor, the Executive Committee considered it desirable to appoint a Ceylonese officer with British agricultural qualifications to work under Mr. O'Brien for a few months and to assist in the agricultural portion of the work pending the appointment of a Physiological Botanist. The post was advertised, and Mr. W. I. Pieris, B.A. (Cantab), was selected and assumed duties on August 3.

Rubber Restriction Fund.—The question of utilising the Rubber Restriction Fund was considered by the Board of Management, it being understood that the entire fund would be released, if need be under an amending ordinance. The Board resolved that the surplus money in the Rubber Restriction Fund should be utilised only for capital expenditure and that application for this money should not be made until a scheme of capital expenditure was drawn up. The Rubber Restriction Fund was therefore not taken into consideration in framing the estimates for 1931.

Accounts.—The audited statement of accounts and the balance sheet up to July 31, and December 31, 1930, are given in Appendices B and C to this report.

A liberal amount has been written off for depreciation of buildings, apparatus, and furniture.

The balance sheet at December 31, 1930 shows cash on fixed deposits and current account and cash in hand and in London, amounting to Rs. 90,405/19 as compared with Rs. 47,345/44 at the end of 1929. From this balance the sum of Rs. 13,740/57 is earmarked for sundry creditors as compared with Rs. 619/86 at the end of 1929, leaving a nett balance in the General Fund of Rs. 76,664/62 to be carried forward to 1931 as compared with Rs. 46,725/58 brought in.

During the year a further sum of Rs. 15,872/10 was spent on the Experiment Station, Nivitigalakele, the development account for which now stands at Rs. 74,610/72.

Proposals for the Development of the Rubber Research Scheme.—The Executive Committee considered at its meeting in June a memorandum submitted by the Chief Technical Officer advocating the purchase of a partly developed estate of say 150 acres of old rubber for experimental work and 50 acres of undeveloped land for new planting, as an alternative to the earlier scheme to develop 300 acres of Crown land. The Committee decided that the purchase of an estate of 200-300 acres was desirable

if a suitable property could be secured and if the proposal proved to be financially practicable. A sub-committee composed of Messrs. H. W. Roy Bertrand, C. Gilliat and T. E. H. O'Brien was nominated to make preliminary enquiries and report on the possibility of acquiring an estate. The sub-committee presented its report to the Executive Committee on July 26, but none of the estates mentioned in the report had undeveloped land attached to it. It was decided that the proposals should be held in abeyance pending the appointment of a Director of Research.

Amalgamation of the Ceylon and Malaya London Advisory Committees.—Certain proposals received from London for the amalgamation of the work of the Ceylon and Malaya London Advisory Committees were considered by the Executive Committees in October and were held over for decision by the new Board of Management.

The Work and Staff in London.—In handing over to the new Scheme, the Executive Committee was in uncertainty as to whether future funds would permit of the continuance of the work and staff in London. The Board of Management reviewed the position and resolved at its first meeting that the London staff and research work be continued on the present footing for 1931.

Physiological Botanist's visit to South India.—With the sanction of the Executive Committee, Mr. Taylor accompanied Mr. H. W. Roy Bertrand upon a visit to estates in South India between April 28 and May 16, 1930. Mr. Taylor submitted a report, which was circulated to members of the Executive and Technical Committees.

Experiment Station, Nivitigalakele.—The members of the Executive Committee, in company with the Visiting Agent, Mr. H. W. Roy Bertrand, visited the Experiment Station on July 26, 1930.

The bridge on the approach road was rebuilt in a workmanlike manner, under the supervision of Mr. F. G. C. Busby of Matugama Estate, at a cost of Rs. 3,552/06.

An office room and an occasional living room with a small kitchen were built adjacent to the tool house at a cost of Rs. 2,197/00.

A detailed survey of the Experiment Station was taken in hand. Copies of the plan with separate outline plans of the eight fields are to be kept at the station and at headquarters.

The Visiting Agent inspected the Station on April 14, July 26 and October 6, 1930, and his reports received the attention of the Committee. The Board of Management has resolved that a Visiting Agent be not employed, but that, should the appointment of a Director of Research remain long in abeyance, the question be reconsidered.

Meetings.—The thanks of the Rubber Research Scheme are due to the Chamber of Commerce and the Grand Oriental Hotel for the free use of their rooms for various meetings of the Committees of the Scheme.

PROGRESS OF WORK.

1. CHEMIST.

Mr.T.E.H.O'Brien assumed duties as Chief Technical Officer on January 1, 1930. After the resignation of Mr. Taylor he took charge of the Experiment Station, Nivitigalakele, and advisory correspondence on agricultural subjects.

The following is a summary of problems which have received attention during the year.

Curing of Sheet Rubber.—Further samples of unsmoked sheet containing paranitrophenol as disinfectant were prepared. Reports from the Imperial Institute indicate that this type of rubber has inferior ageing properties, but the latest results suggest that the inferiority is connected with the presence of paranitrophenol. The subject will be further investigated but, owing to the success of experiments in the preparation of smoked sheet with a low consumption of firewood, there is now less inducement for the introduction of a new type of rubber.

Experiments on the preparation of smoked sheet were carried out in the "half-scale" smokehouse at the laboratories. In the first test heat was provided by radiation from steam pipes and smoke was generated by slow combustion of rubber wood in a small iron drum. In the second test heat was provided by means of a coke stove, smoke being generated as in the previous test. The rubber prepared by both methods was satisfactory in appearance and was valued in Colombo at full market price. Subject to confirmatory tests on the quality of the rubber, curing over a coke fire in presence of wood smoke may be regarded as a practicable method for the preparation of standard smoked sheet with a minimum consumption of firewood.

Measurements of air movement in the smokehouse were made and conclusions were reached regarding the amount of ventilation required for efficient smoking under estate conditions. The effect of thickness of the sheet on the rate of drying was investigated and it was concluded that a material improvement can be effected by reducing the thickness of the sheets. A coagulating pan of suitable dimensions for preparing sheets to fit a standard packing chest was designed and has given good results.

Samples for the Imperial Institute.—Samples of smoked sheet and crepe from a large number of estates were collected and forwarded to the Imperial Institute for an investigation of variability of plasticity. Thirty additional samples were submitted in connection with various investigations.

Power Consumption in Crepe Rolling.—Some preliminary measurements of the power consumption of crepe rollers were made at a factory in the Matale district where the machines are driven by electric motor. The results were approximately in accordance with the opinion of engineers and planters regarding power requirements. It is hoped to repeat the tests later using more accurate recording instruments.

Bordeaux Mixture.—Tests were carried out to determine the extent to which the keeping qualities of Bordeaux mixture can be improved by the addition of a small proportion of cane sugar. It was concluded that Bordeaux mixture containing 10 % of cane sugar (based on the weight of copper sulphate) retains its colloidal properties fully for a week and can be used satisfactorily for at least a month. Preliminary tests were also made on the preparation of a combined fungicide and insecticide by the addition of a proportion of sodium arsenite to Burgundy mixture.

2.—PHYSIOLOGICAL BOTANIST.

Mr. R. A. Taylor resigned his appointment with the Research Scheme in August. The following is a summary of his work up to that date and of the progress of the Experiment Station, Nivitigalakele, for the year.

EXPERIMENT STATION.

Satisfactory progress can be reported for the period under review. Growth of the trees showed marked improvement and a luxuriant growth of cover plants was maintained in most areas.

Erect cover plants were pruned twice during the year, the prunings being buried in pits at the back of the platforms. It is noticeable that there is a tendency for the creeping plants gradually to swamp the erect plants. On the advice of the Visiting Agent the terrace platforms were cleared of cover plants. Mikania scandens became established in isolated patches among the cover plants and steps were taken for its removal by forking. Cuscuta chinensis, which grows as a parasite on Mikania, has been established in experimental plots and is under observation.

Budding in the 1926 and 1927 clearings was completed with the exception of 15 plants. The 1928 clearing has been divided into 96 plots of 25—30 trees. Budding was carried out in 53 plots, material from the other selected mother trees not being available until next year. It should be noted that the shortage of budwood arises from the decision to reduce the size of the plots from 100 to 25—30 trees. Details of budding are given as an appendix to the report on the Experiment Station.

Fourteen estate employees were trained in budding during the year, the period of instruction in most cases amounting to one month. A nursery of approximately 4,000 plants was laid down for instructional purposes during 1931. Seed from three high yielding Heneratgoda trees was planted out with a view to selecting high yielding seedlings by test pricking.

A new kitchen was added to the Conductor's bungalow.

Test Pricking of Clones.—Trees from a number of clones at the Experiment Station were test pricked by three different methods. Much reliance cannot be placed on such tests

but it is a hopeful sign that several local clones compared favourably with two Prang Besar clones which were included for comparison.

Mother Trees.—The Research Scheme has records of 674 trees on 99 different estates but in a number of cases these are incomplete. 41 estates forwarded quarterly records of high yielding trees during the year. Although these figures are encouraging it will be necessary to secure records from many more estates in the search for the highest yielding trees in the island.

Replanting. -Considerable interest was shown in the question of replanting existing rubber areas and a number of estates have embarked on small experimental replanting programmes. The Research Scheme has been called on for advice in a number of cases and is keeping in touch with the progress of the experiments.

3.—MYCOLOGIST.

Mr. R. K. S. Murray continued his duties as Mycologist. His report is attached, of which the following is a summary :—

Oidium Leaf Disease.—Special attention has been devoted to the problem of controlling *Oidium* leaf disease, the severity of which is causing anxiety in certain mid-country districts.

As the result of manuring experiments carried out on Kandanuwara Estate, Matale, it has been concluded that manuring alone is of little or no value on severely affected areas. On estates where the defoliation is not severe, however, the application of nitrogenous manures may be of benefit in minimising the effect of the disease.

The projected experiments on liquid spraying with Sulfinette were abandoned in favour of dry spraying with sulphur powder, and experiments on the latter treatment were carried out on Kandanuwara and Bandarapola Estates in the Matale district, and Gonakelle Estate, Passara. Disappointing results were obtained on Bandarapola owing to an insufficient number of applications, but on Kandanuwara a marked improvement in the foliage of the dusted field as compared with the neighbouring control area was evident. The results of the treatment were demonstrated by photographs and also judged by the examination of a number of individual trees in plots scattered throughout the dusted and undusted areas.

The experiments on Gonakelle Estate shed light on various points concerned with the dusting operation, and the following conclusions, amongst others, were drawn :—

(1) In order that the dusting operations should achieve the maximum success the first application should be made at the earliest appearance of young leaf after " wintering."

(2) It is of great importance to ensure that every portion of the field receives its full quota of sulphur.

As the result of a number of experiments it has been concluded that Tea pluckings in the neighbourhood of dusted Rubber are unlikely to become tainted with the sulphur, and that provided reasonable care is taken no fear on this account need be entertained.

Sulphur dusting is undoubtedly a practical and effective means of controlling *Oidium* and with further experience better results are confidently anticipated.

Disinfection of Imported Budwood.—Further experiments to determine an effective and harmless method of disinfecting imported budwood and budded stumps have been carried out, and the best results have been obtained by soaking in a dilute solution of copper sulphate. A preliminary report was issued, but no practical recommendations can yet be made.

Disease of Bud-Shoots.—The *Phytophthora* disease of young bud-shoots mentioned in the Mycologist's Report for 1929 has received further investigation, and many specimens of affected shoots were received.

Bark Rot.—Experiments were conducted with tar emulsion samples which, on account of their special properties, promise to be of value in the control of bark rot. The stability of these emulsions was not entirely satisfactory, and it is hoped that further samples will be prepared and tested.

Watson's Tapping Process.—An experiment is in progress on Culloden Estate to test a patent tapping process devised to prevent losses of latex by rain. The results for the last six months of 1930 are encouraging, and the experiment is being continued.

Advisory Work.—Advisory work, as judged by the number of specimens and enquiries received and estates visited, shows a considerable increase as compared with 1929.

4.—RESEARCH WORK AT THE IMPERIAL INSTITUTE.

A full report on the work of the London Branch of the Research Scheme is attached, of which the following is a summary:—

Plasticity.—Experiments on the changes of plasticity of rubber during storage under varying conditions suggest that two opposing factors are concerned in the changes which occur: (a) a spontaneous hardening, (b) a softening due to oxidation. Tests in Java indicate that rubber may either harden or soften during storage whereas the general experience in England is that rubber almost invariably hardens during storage. This effect is probably due to the difference of temperature in the two countries, as it has been shown that increased temperature has a greater effect in increasing oxidation than in increasing spontaneous hardening.

Experiments carried out during the year confirmed the previous conclusion that the addition of Sodium bisulphite to latex increases the tendency of crepe to become hard on keeping. The effect, however, is not sufficient to warrant any modification of the present factory procedure.

Further samples were examined with a view to studying the effect of temperature of rolling during blanketing on the plasticity of crepe. In order to obtain blanket crepe of uniform hardness it is considered desirable that the blanketing rolls should be water cooled.

Uniformity of Plantation Rubber.—Monthly samples of crepe and sheet from 3 estates in Ceylon were examined. The results showed that a satisfactorily uniform rubber can be obtained over a long period when the latex is collected from the same group of trees and standard methods of preparation are followed.

Comparison of the results with those of tests on rubber from a carefully controlled estate in Java, supplied by the Proefstation Voor Rubber, indicated that the rubber from Ceylon was as uniform as that from Java. Obviously, however, no conclusions can be drawn regarding the extent of variability in estate rubber from either country.

Three samples of rubber from different small holdings in Ceylon had excellent mechanical and ageing properties but showed considerable variability in rate of vulcanisation. A more detailed investigation of the properties of village sheet is to be undertaken.

Samples have been obtained from about 300 Ceylon estates in order to determine whether any of them are producing abnormal types of rubber, and then to investigate the methods of preparation.

Drying of Sheet Rubber.—Further samples were examined in connection with the investigation in Ceylon of methods of curing sheet rubber. It was invariably found that smoked sheet was superior in ageing properties to air-dried sheet, especially when the latter was dried at temperatures above 90°F. All the samples contained paranitrophenol. As samples of air-dried sheet examined in 1925 had excellent ageing properties it was suggested that the inferiority was connected with the presence of paranitrophenol. This view has been confirmed by preliminary experiments and is being further investigated.

Samples dried in hot air in presence of smoke had excellent ageing properties, particularly one in which the smokehouse was heated with a coke stove and smoke produced by coconut husks.

Soaking Coagulum in Boiling Water.—On one estate where crepe is manufactured the coagulum is soaked in boiling water before passing to the smooth roller with a view to improving the colour of the product. Examination of a sample of the rubber showed it to have much improved plasticity but to be deficient in acetone-soluble acids. Further investigation of this treatment may suggest a method for preparing a plastic rubber which is not deficient in acetone-soluble acids.

Up-River Fine Para.—At the request of Mr. C. E. A. Dias a sample of Up-river fine Para rubber was examined. Although the material had excellent properties it was not superior to some samples of plantation rubber and fine hard Para previously examined at the Imperial Institute.

5.—PUBLICATIONS.

There was steady demand for copies of Mr. O'Brien's booklet on the preparation of plantation rubber, which was published in October 1929.

Following on that, a similar publication was prepared by Mr. R. A. Taylor, the Physiological Botanist, on budding of rubber, and it was issued in August 1930.

Mr. R. K. S. Murray, Mycologist, completed in the course of the year a booklet on diseases of rubber in Ceylon, and copies will be available early in 1931.

Quarterly Circulars.—Reports and memoranda dealing with questions affecting the industry continued to issue at quarterly intervals. Their appearance in the Tropical Agriculturist and notice of them in the press broadcast them to a large circle of readers.

The following special subjects were dealt with in the Quarterly Circulars:—

The replanting and rejuvenation of old rubber.

A disease of young bud-shoots caused by Phytophthora Palmivora.

Pricking tests on some young bud-grafts.

Report on the market possibilities of fractionally coagulated crepe.

A preliminary investigation of the effect of different conditions of storage on the hardness of raw rubber.

Sulphur dusting as a means of controlling Oidium.

Termites attacking Hevea Brasiliensis in Ceylon.

A recent outbreak of Xylaria Thwaitesii root disease.

Some common pests and diseases of young hevea buddings.

Notes on the appearance of samples of smoked sheet and blanket crepe from estates.

The Control of Oidium leaf disease.

Sulphur dusting experiments on Gonakelle estate.

On the effect of adding sodium bisulphite to latex on the plasticity of crepe.

A comparison of methods of preparing plantation rubber in Ceylon, Malaya and Java.

Special Circular.—Upon the value to rubber growers of the work in London of the Ceylon Research Scheme.

Bulletins of the Rubber Growers' Association.—The bulletins published by the Rubber Growers' Association were issued by the Scheme to all subscribers who do not receive them directly from London. The following special articles appeared:—

January: Rubber under rails,
Rubber in the automobile industry,
Straits Settlements statistics relating to rubber.

February:	Cessation of tapping, A review of F. M. S. statistics relating to rubber production, The Ross Institute.
March:	Value to rubber growers of the work in London of the Ceylon Research Scheme, Rubber in the automobile industry.
April:	Cessation of tapping.
May:	Native rubber cultivation in the Netherlands East Indies.
June:	Ceylon Rubber Research Scheme, Warehousing of rubber, Rubber in Borneo.
July:	Rubber roadways annual report, Rubber Research Institute of Malaya.
August:	Rubber research on British plantations, Budgrafting, Rubber in aircraft design.
September:	Antwerp Exhibition, Developments in sprayed rubbers. Ceylon Rubber Research Scheme.
October:	Rubber situation, Speeding up the commercial development of rubber roadways.
November:	Anti-malarial work, Research notes.
December:	Native rubber cultivation in the Netherlands East Indies, Research notes.

W. YOUNGMAN,

Chairman,

Rubber Research Scheme (Ceylon).

PERADENIYA,

1st, March, 1931.

CHEMIST'S REPORT FOR 1930.

Duties as Chief Technical Officer were taken over at the beginning of the year. After the resignation of Mr. R. A. Taylor in August, charge was taken of the Experiment Station, Nivitigalakele, records of mother trees and advisory correspondence on agricultural subjects. The amount of time available for experimental work on chemical subjects has therefore been materially curtailed. Investigations carried out during the period under review are dealt with below.

CURING OF SHEET RUBBER.

In Chemist's report for 1929 it was pointed out that sheet dried in hot air without smoke has a characteristic surface stickiness which is not present in smoked sheet. Experiments have shown that the stickiness can be reduced to some extent by soaking the sheets, after drying, in a dilute solution of gambier extract, but the treatment cannot be recommended as it appears to have an adverse influence on the ageing properties of the rubber (in presence of para-nitrophenol). Soaking in a dilute solution of sodium silicate also removed the surface stickiness to some extent. As mentioned in a previous report, the stickiness of air-dried sheet is not regarded as a serious defect by the London staff of the Research Scheme or by London brokers.

Reports which are now to hand from the Imperial Institute on the vulcanising properties of a series of samples submitted last year indicate that unsmoked sheet, containing para-nitrophenol (P.N.P.) as disinfectant, is inferior to smoked sheet in ageing properties after vulcanisation. Samples (without P. N. P.) which were examined some years ago were reported to have good ageing properties, and it seemed possible that the inferior ageing properties found in recent samples might be connected with the presence of P. N. P. Samples for the investigation of this point were forwarded to the Imperial Institute some months ago and a cable received recently indicates that P. N. P. has an adverse influence on the ageing properties of unsmoked sheet. It should be noted that P. N. P. does not affect the ageing properties of smoked sheet. The question of developing unsmoked sheet as an estate grade remains open for further investigation but, owing to the success of experiments in the preparation of smoked sheet with a low consumption of firewood, there is now less inducement for the introduction of a new grade.

In view of the difficulties connected with the preparation of unsmoked sheet attention was directed to the preparation of smoked sheet with a minimum consumption of wood fuel. Following on small scale experiments tests were carried out in the "half-scale" experimental smokehouse at the laboratories involving the preparation of approximately 1½ tons of rubber.

In the first test heat was provided by radiation from steam pipes in the base of the smokehouse, the boiler being fired with coal. Smoke was generated by combustion of rubber wood in a small iron drum fitted with a perforated lid. The rubber was sold on the

Colombo market and received a satisfactory report from the brokers, securing full market price. It was estimated that the consumption of wood for smoking in a full sized smokehouse of modern design would not exceed 1 "yard" to 2 tons of rubber or approximately 1 lb. firewood to 8 lbs. rubber. The cost including coal or coke for firing the boiler would be about the same as that entailed by ordinary smoking with firewood valued at Rs. 2-50 per yard. The disadvantage of the method is that a somewhat costly boiler installation is required.

In the second test heat was provided by means of a coke stove in the base of the smokehouse, smoke being generated as in the previous test. The rubber prepared by this method was satisfactory in appearance and was valued in Colombo at full market price. A sample examined at the Imperial Institute was slightly superior in ageing properties to ordinary smoked sheet. Consumption of firewood in a full sized modern smokehouse would be approximately 1 yard to 2½ tons rubber and the total cost somewhat lower than that entailed by the use of steam pipes.

Subject to confirmatory tests on the quality of the rubber this system of curing may be regarded as a thoroughly practicable method for the preparation of standard smoked sheet with greatly reduced consumption of firewood and may, in some cases, prove more economical than normal smoking.

Further tests were made on the ventilation of the experimental smokehouse. With the room full of rubber and at a temperature of 115°F air movement amounted to 5—6 complete changes of air per hour, the figure being approximately the same as that found when the room was empty. The humidity of the air, a few hours after fresh sheet had been placed in the smokehouse, amounted to 60% of saturation. The ventilation may therefore be regarded as ample and could probably be further reduced except for the risk that stagnation might occur in parts of the room. As a basis for ventilation of a smokehouse it is suggested that bottom ventilating holes should amount to 1 square foot for each 1,500 cubic feet capacity and top ventilators to 1 square foot to 3,000 cubic feet capacity, with provision for adjustment.

Attention has been given to the question of the effect of thickness of the sheets on the time required for drying. Delay in drying is frequently due to the presence of thick edges or corners rather than to the average thickness of the sheet but there is no doubt that the rate of drying can be materially increased by reducing the thickness of the rubber. A sheet weighing 1½ lbs. and of suitable dimensions to fit a plywood packing chest, *viz.* "23 × 18," is considered to be suitable in thickness for efficient drying. Such sheets can be dried and smoked in 5—6 days if the temperature of the smokehouse is maintained at a suitable level.

A coagulating pan, of suitable size to produce a sheet of the above dimensions and with sloping sides to prevent thick edges in the sheet, was designed and has given good results. A report on the investigation outlined above was given in a paper entitled "the curing of sheet rubber" which was read at the Agricultural Conference, Peradeniya, October 1930. It will be reprinted as bulletin 51 of the Research Scheme.

SAMPLES FOR THE IMPERIAL INSTITUTE.

In accordance with arrangements made with the Superintendent of the London laboratories of the Research Scheme during his visit to the East, samples of crepe and sheet were obtained from a large number of estates, for the purpose of an investigation of variability in plasticity. 205 samples of smoked sheet and 118 samples of crepe were forwarded for this purpose. The opportunity was taken to make a critical examination of these samples from the point of view of appearance before despatch to London, and a report was published in the 3rd Quarterly Circular for 1930.

Arising from the investigation of the properties of crepe prepared by fractional coagulation, one chest of first fraction crepe and one chest of second fraction crepe were forwarded to London for manufactures' trials. 22 samples were forwarded for examination in connection with the investigation on the curing of sheet rubber, and 6 samples for other purposes.

MISCELLANEOUS INVESTIGATIONS.

Power Consumption in Crepe Rolling.—Some preliminary measurements of the power consumption of crepe rollers were made at a factory in the Matale district where the machines are driven by electric motor. The measurements were made by voltmeter and ammeter and are therefore not likely to be very accurate, but it is hoped to make further tests later using more accurate instruments. A summary of the present series of measurements is as follows:—

Idle roller (18″ wide)	...	...	0.3 –0.5 H.P.
Masticating coagulum.	...	...	5—7 H.P.
Smooth rolling	...	...	3—4 H.P.
Blanketing	...	...	10–12 H.P.

Bordeaux Mixture.—In view of the considerable use of Bordeaux mixture in connection with diseases of young budded plants and the inconvenience of preparing the mixture daily, a test was made to determine the extent to which the keeping qualities of Bordeaux mixture are improved by addition of a small proportion of cane sugar, as proposed by Kelhofer. It was found that Bordeaux mixture containing 10% of pure cane sugar (based on the weight of copper sulphate) retains its colloidal properties fully for 7 days and can be used satisfactorily for at least a month. Locally purchased sugar gave inferior results but would probably be satisfactory for estate purposes.

A few preliminary tests were also made to determine whether Burgundy mixture (copper sulphate and washing soda) would prove more convenient than Bordeaux mixture for use on a small scale in nurseries, and also whether a combined fungicide and insecticide could be prepared by incorporation of a proportion of sodium arsenite in Burgundy mixture. It was found that both Burgundy and Burgundy-arsenite mixture caused scorching of the young leaves when used at 1% dilution. Further tests will be made with more dilute mixtures. Burgundy mixture loses its colloidal properties within 24 hours and cannot be

stabilised by the addition of sugar. Burgundy-arsenite mixture when made in suitable proportions appears to retain its colloidal properties indefinitely.

VISITS AND ADVICE TO ESTATES, CORRESPONDENCE, ETC.

Visits were made to 18 estates for the purpose of advising on manufacture, etc., and full reports furnished for the information of the superintendents and agents.

Visits were also made to the Central Experiment Station, Peradeniya and the headquarters of the Tea Research Institute. The Experiment Station, Nivitigalakele, was visited with the Physiological Botanist at approximately monthly intervals up to August and thereafter 5—6 times monthly.

Two meetings of the Executive Committee and one meeting of the new board of Management were attended by invitation.

Enquiries were dealt with on the following subjects :—

Manufacture. —Preservation of latex; the Revertex and other processes for concentrating latex; specific gravity of latex; rubber content of latex; technique of fractional coagulation; discoloration of crepe; output of crepe rollers; mould and fungal spots on crepe; preparation of sole crepe; packing crepe; marketing thin crepe; prevention of mould on smoked sheet; bubbles in smoked sheet; discoloured patches in smoked sheet; overheating during smoking; design of smokehouses; preparation of partially smoked sheet; blisters on coagulum; variation in hardness of coagulum; the effect of sodium bisulphite on aluminium; scope for the use of aluminium utensils in rubber factories.

Agricultural, etc.—Budding plants of different ages; retaining buds in a dormant state; pollarding for budwood; identification of clones by seed comparison; supplies of budwood from imported clones; buds dying back between 1st and 2nd examination; bark renewal of budded trees; planting distances: economic life of rubber trees; necessity for resting during wintering period; tapping on full circumference every 3 days; comparative yields from 2-day and 3-day tapping; the nitrogen content of vigna leaves; the cause and treatment of brown bast; effect of manuring on yield; quick-growing cover crops.

A regular correspondence has been maintained with the Director and chemical staff of the Rubber Research Institute of Malaya on topics of mutual interest, and samples of sheet rubber were exchanged for examination.

Total correspondence inward amounted to 1,377 letters and outward to 1,499 letters.

VISITS TO THE LABORATORIES.

The laboratories were visited by the headmaster and 17 students of the Peradeniya Farm School; the headmaster and 16 students of the Jaffna Farm School; Dr. P. J. S. Cramer of the Dunlop Plantations Company; and approximately 64 superintendents of estates.

PUBLICATIONS.

"Notes on the appearance of samples of smoked sheet and blanket crepe from estates" (Quarterly Circular, part 3, 1930).

"The curing of sheet rubber." Paper read at the Agricultural Conference, Peradeniya, October 1930. To be reprinted as Bulletin 51.

SUMMARY OF WEATHER RECORDS AT CULLODEN LABORATORIES.

	1930.	1929.
Rainfall	158.24 ins.	144.68 ins.
Highest monthly rainfall ...	45.725 „ (May)	28.345 „ (May)
Highest daily rainfall ...	6.66 „ (May 30th)	8.95 „ (May 24th)
Highest shade temp. recorded (day)	94.0°F (March 23rd)	93.0°F (March 28th)
Lowest shade temp. recorded (day)	74.7°F (May 6th)	79.7°F (May 24th)
Lowest shade temp. recorded (night)	66.3°F (Jan. 22nd)	64.4°F (Jan. 16th)

T. E. H. O'BRIEN,
Chemist.

RESEARCH LABORATORIES,
CULLODEN,
NEBODA.
3rd February, 1931.

PHYSIOLOGICAL BOTANIST'S REPORT FOR THE PERIOD JANUARY TO AUGUST 1930.

As in 1929 the work of this department can be conveniently divided into three sections: advisory, selection and study of mother trees, and management of the Experiment Station. The departure of Mr. Mitchell, the interest now taken in budding and more recently the question of replanting of old rubber have all been responsible for a great increase in the work described as advisory. This with the time spent on the other sections has resulted in the almost complete exclusion of any purely botanical work.

EXPERIMENT STATION.

Satisfactory progress can, it is thought, be reported for the period under review. The earlier difficulties encountered due to the excessively poor quality of the soil and the comparative inexperience of the budders have been overcome and there should be little difficulty in completing the budding of the Station. Growth all round has improved to such an extent that the visiting agent has reported that no furthur manuring programme need be undertaken this year except in the case of occasional backward plants.

Lay-out of the different clearings.—The clones in the 1926 clearing were mixed up to average out soil conditions and to allow of as many combinations of stock and scion as possible. This will render difficult future tapping tests and yield recording. In the 1927 clearing different stocks were kept to different rows running up hill and the clones were allotted varying numbers of terraces. In this way combinations of stock and scion were roughly varied and future tapping arrangements will be simplified as all the members of a clone are adjacent.

In the 1928 clearing, in view of a criticism that time was being wasted in selecting stocks, no special arrangements have been made to allow of different combinations although most of the stocks are known and labelled. The whole area has been divided into blocks of 25 to 30 trees and clones will in future be of this size, single wire fences have been erected round the blocks and large block labels provided (by August this fencing has not been completed over the whole area). This extra labelling is in addition to the usual tree labels which show origin of stock, scion number and number of tree in the block.

Budding.—The 1926 and 1927 clearings can now be reported as complete. Considerable replacement of poor plants with budded supplies has been necessary in these clearings but at the date of writing (August 12th) this has been carried out except in a few cases in the 1927 clearing. Plants are available for the purpose in the nursery and will be put out as soon as suitable weather obtains.

As considerable experience has been obtained in the planting out of budded stumps, a few words on the method finally adopted may not be amiss. The plants are not cut back or ringed until the day of transplanting when they are 'stumped' at a height of 3 feet

They are put out in this form and shoots are allowed to grow from the top until they reach a length of about 18 inches. By this time it can safely be assumed that the roots have settled down to their new conditions and the plants can be cut back to within 6 inches of the bud. Only two deaths in several hundreds have so far been reported.

In the 1928 clearing budding has been started on 23 clones, of which seven have been completed and two are nearly complete. In the case of four clones further budwood is not at present available. Success has been reasonably high considering that learners from estates had to be trained on a number of these plants.

Training in Budding.—Interest now taken in budding is shown by the fact that since April 1st fourteen estate employees have had training in this work. Wherever possible one full month has been spent on the station by each of these men. This allows of full examination of their earlier work before their departure.

Nurseries.—In order to avoid the necessity of using important plants for training purposes in future, a fairly large nursery has been laid down this year. Unselected seed has been used.

Beds of seeds from the three high-yielding trees at Heneratgoda, Nos. 2, 24 & 140, are being laid down. It is the intention to have these seedlings test-pricked when they are 15 to 18 months old with a view to finding high yielders. Those selected in this way will be used as budwood for the establishment of small clones.

Visits by budders to estates.—During the period under review the station budders have visited 10 estates and have given demonstrations or carried out small budding programmes.

Test-pricking of clones.—Trees from a number of clones in the budwood nursery and in the earlier clearings have been test-pricked by three different methods and the results were published in the Quarterly Circular, Part 1, 1930. Much reliance cannot be placed on such tests, but it is a hopeful sign that a fair number of our local clones take a higher place in the lists than do the two Prang Besar clones put in for comparison.

Budwood Nursery.—Numerous additional clones including ten from South India have been put out this year.

A detailed plan showing each individual tree has been prepared and a statement showing stocks of budwood in hand at the end of June is available. Many of the older unbudded stocks are now rather large for budding and a proportion of these have been cut back to 3 feet. A previous trial showed that such pruning produced vigorous young branches which could be easily budded. The height at which the budding is carried out for multiplication purposes is immaterial and in fact better growth is frequently obtained on older plants at a height of 2 to 3 feet than at ground level.

Much of the budwood in the nursery is now too old and these plants will have to be pruned back. It may also be desirable at an early date to cut out certain of the less desirable clones so that the size of this nursery can be kept within reasonable limits.

Cover crops and green manures.—Growth has been luxuriant. The taller growing plants between the terraces have been pruned twice and the height attained by these before pruning averaged at least 5 feet. The prunings have in each case been buried in pits on the terraces, pits being provided in alternate intervals between trees. In many cases this accommodation was insufficient and stacks of Adco synthetic farm-yard manure were prepared with the remaining material. The excellent growth of these plants is in part due to the heavy application of manure given in 1929. 400 lbs. per acre of the mixture Basic slag 4 parts and sulphate of potash 1 part were put out. The continued addition of this quantity of green material will go a long way to improve the condition of the soil on the Station. Where Adco is being prepared it has been found preferable to build a few large stacks rather than many small ones. Transport is heavier but a much more satisfactory material is obtained. This has to date not been the general practice at Nivitigalakele.

There is an excellent cover all over now except on two small patches on the steep hill side where it has been found difficult to anchor the loose soil thrown out during terracing. Attempts are to be made to establish Pueraria phaseoloides in these areas.

Weeding.—In spite of the heavy cover weeding costs have been high. A little trouble with Illuk has been encountered but this is now under control. Mikania scandens is on the increase and control presents difficulty. Its rapid growth makes monthly weeding rounds insufficient. A suggestion has been made that a parasite (Cascuta chinensis) should be introduced. There can be no doubt of the efficacy of this method but so far it has not been adopted in view of the possibility of its affecting the cover crops.

In some areas a small grass has taken possession of ground previously covered by vigna (Dolichos Hosei), and this has necessitated complete temporary clearing. Such areas are, however, small.

Buildings.—On capital account expenditure has been small. A new kitchen has been built for the conductor's bungalow, the old kitchen which is a large room being converted into an extra bedroom. This will be available when occasion arises to accommodate estate employees who are studying budding etc. at the Station.

The usual routine repairs have been carried out on all buildiugs and all are in excellent condition.

Roads.—The bridge on the main cart road was raised by 2 feet early in the year but unfortunately heavy rain in March and again in May caused floods which completely undermined the foundations. The road at this point crosses a paddy field, the subsoil of which is sandy, and the original foundations had not been sunk sufficiently deeply to withstand the rush of water experienced. At the present time the road is closed pending the construction of a new bridge.

Paths.—Paths have been cut through all fields and inspection by visitors is now easier.

Staff.—This has consisted of :—

Mr. S. B. O'Neil	...	Conductor
Mr. Gunawardene Mr. Kannangara	...	Budders
Mr. Anbiah	...	Clerk (at Culloden)

These have all discharged their duties in a satisfactory manner.

Labour.—As all the opening work has been completed the resident labour force has been reduced. Labour has at all times been sufficient for requirements and additional workers are easily obtained from amongst local villagers.

Visitors.—Seventy visitors have signed the book since the beginning of the year. The Station has been inspected twice by the visiting agent, Mr. H. W. R. Bertrand, and once by members of the Executive Committee.

In general, interest has been shown only in budding and budwood nurseries and during the period under review a considerable portion of my time has been spent in showing visitors round and giving details of the budding method and care of budded plants.

Monthly report forms.—A new type of report form was suggested by Mr. Bertrand and with slight alterations this has been adopted for the Station. The feature of this report which commends it specially is its form. It consists of 14 sheets of foolscap size and so permits of copies being typed. The convenience will be recognised when it is explained that seven copies are required every month.

Mother Trees.—Records are now being received of the yields of 674 trees situated on 99* different estates. A large number of estates have not yet sent in records of their best trees but the increase in this respect during the past year has been gratifying.

Quarterly returns are now received and total yield of the tree for each month, number of tappings, average per tapping in weight of dry rubber, are all given together with the length and height of the cut at the beginning and end of each quarter. These data permit of calculation, if desired, of yield per unit, length of cut, yield per inch of bark removed, and also allowance can be made for the height of the cut above ground level.

The bark of most trees under consideration has now been examined and details are available of situation of the tree, branching habit, etc.

21 estates were visited for the purpose of inspecting high-yielding trees and bark samples have been taken from these and examined along with samples from 4 other estates which were not visited.

ADVISORY WORK.—Seventeen visits of an advisory nature were made during the year. These were largely concerned with budding and the replanting of old rubber.

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*41 estates forwarded regular quarterly records during the year.

In Ceylon at the present time there are numerous small clearings which were planted during the period 1926 to 1928, with unselected seed, and a question which has been frequently asked is whether these can now be successfully budded. In general the answer has been in the affirmative but that the operation would be more difficult than with younger, vigorously growing plants. Incidentally more success has been registered in the budding of plants of this size where green budwood has been used than with more mature material.

It would appear to be more economical to make use of these large stocks than to reclear and replant. A large root-system is available and the growth of the bud shoots is much more rapid than is the case with younger transplanted budgrafts. It is probable that by budding the older plants the time which must elapse before the clearings reach tappable size will be shorter by more than one year than could be expected were replanting carried out.

This question of treatment of older clearings is likely to engage attention in Ceylon at least for another year. Many estates have just established budwood nurseries and must still wait a year before they will have sufficient budwood to complete the work.

Budding of relatively old plants is more costly owing to the extra wrapping material required and to the lower percentage of successes registered in each round, but taken all round it would appear to be cheaper than the alternative method of reclearing and replanting. It is probable that the patch and coir rope method of wrapping will prove more economical for this type of budding than the more common tape.

Correspondence on budding in general has been considerable.

A number of estates have started small experiments on the replanting of poor yielding areas. In most cases 5 to 15 acres are being cleared and replanted with budded stock.

There are many points in connection with replanting which must be considered from the point of view of economics. In the first place it is probably unwise in many cases to rush into extensive replanting yet. Better clones than are at present available may be on the market soon and may, to a certain extent at least, supercede some of the earlier clones. Also as much as possible the capital invested in the old trees should be realised before they are removed. We do not yet know the best way of doing this and a start should be made in a small way.

Tentative programmes have been drawn up for certain estates which sent in enquiries on the subject, but much of the advisory work on replanting has been connected with the laying down of budwood nurseries and seedling nurseries for future budding purposes. Large quantities of budwood and budded stumps have been imported in 1929 and 1930 and budwood nurseries find a place in the scheme of all the more progressive companies. This tends to show that estates will be prepared should replanting become necessary.

OTHER WORK.—The question of disposal of timber during new clearing work or in replanting schemes was enquired into early in the year. The lack of humus matter in

tropical soils is well known and it was thought that much of the smaller and softer timber might be converted into valuable humus-forming material. The question was the subject of correspondence with the Director of the Imperial Institute who got into communication with Messrs. Agricultural Developments Co. (Adco) and with manufacturers of disintegrators. Estimates for portable disintegrators were received along with suggestions for treatment of the broken-up material. Owing to funds not being available no work could be done on a large scale.

A small-scale experiment carried out in a metal drum showed that material broken up by hand was not sufficiently finely divided to ensure rapid decomposition. The temperature did not rise as is usual in the preparation of Adco synthetic farmyard manure from green material and at the end of six months the wood had blackened but otherwise was of much the same consistency as at the start.

It is thought that the subject is of sufficient importance to merit a thorough trial when funds permit. The disposal of timber may be a problem if replanting is taken up on any scale.

Office Work.—Correspondence has consisted of 609 letters inward and 547 outward (to August 13th) and has been largely advisory in nature. Reports in detail have been made to the superintendents and agents of any estate visited in an advisory capacity.

The Experiment Station books have been kept up to date, and in this connection I should like to record that since his appointment in April Mr. Anbiah has been of the greatest assistance.

Publications:—

"The Budding of Rubber." (issued as a Handbook)

"Pricking tests on some young bud-grafts in the Rubber Research Scheme Experiment Station budwood nursery." (Quarterly Circular, Part 1, 1930).

"The Replanting and Rejuvenation of old rubber areas." (Quarterly Circular, Part 1, 1930.

"Replanting and Rejuvenation", to be presented at the Agricultural Conference at Peradeniya in September. (Quarterly Circular, Part 4, 1930).

(Signed) R. A. TAYLOR.

RUBBER RESEARCH LABORATORIES,
CULLODEN ESTATE,
NEBODA.
18th August, 1930.

EXPERIMENT STATION—NIVITIGALAKELE.
REPORT FOR PERIOD AUGUST—DECEMBER, 1930.

The Physiological Botanist's report for the period prior to his resignation from the Research Scheme deals fully with the general progress of the Station up to that time (August 20th). The present report refers only to matters in which progress has since been made.

Charge of the Station was handed over by Mr. Taylor on August 12th. Mr. W. I. Pieris joined the Scheme at the beginning of August as Agricultural Assistant. His time has largely been spent at the Experiment Station, both in making himself thoroughly acquainted with budding and other agricultural methods and in supervising the work in progress.

The Visiting Agent, Mr. H. W. R. Bertrand, inspected the Station on October 6.

NITROGENOUS PLANTS.

On the advice of the Visiting Agent cover crops were removed from the contour platforms, this work being carried out during September, October and November. Ground covers were rolled back over the edge of the terraces; erect plants were uprooted and buried in pits where available.

A number of overgrown Albizzia trees situated in sheltered parts of the estate, which were overshading the rubber, were removed. Albizzia stumps were planted out in exposed positions where there appeared to be insufficient wind protection. Several hundred gliricidia cuttings were planted round the boundaries with the object of providing live fence posts.

Pruning of erect cover crops was started towards the end of December with a view to completing this work before the dry season set in. It is noticeable that the creeping cover plants are gradually swamping the erect plants.

Mikania scandens has become established in small patches among the cover crops growth having started in most cases from silt pits in which green manures have been buried. Such patches were marked with flags and the Mikania removed by forking. It has not yet been completely eradicated but is well under control and there should be no difficulty in removing it completely within the next 12 months.

Cuscuta chinensis, which lives as a parasite on Mikania, has been established in several experimental plots with a view to observing whether it is harmful to the other cover plants. In these plots Cuscuta has been seen growing on Dolichos Hosei (vigna), Centrosema pubescens, Desmodium gyroides, but it does not thrive as it does on Mikania. On the other hand it is doubtful whether Cuscuta can spread sufficiently rapidly to control the growth of Mikania effectively.

WEEDING.

The clearing of the platforms made weeding difficult during succeeding months owing to regrowth of the cover crops from runners and seedlings (especially Calopogonium mucunoides seedlings). By giving the work out on contract to Sinhalese villagers it has been practicable to maintain full monthly weeding rounds at a cost of approximately Re. 1/- per acre.

BUDDING.

Supplying in the 1926 clearing was completed in August and the 1927 clearing was completed in October with the exception of 15 plants. During the drought in December there were a number of casualties among the supplies and there are at present 79 vacancies in the two clearings. A small number of trees in the 1926 clearing should be sufficiently large for test tapping in the latter part of 1931.

The 1928 clearing is divided into 96 plots of which two plots are being reserved as unbudded controls. 94 clones have been selected for testing by Mr. Taylor but this year budwood was only available for 53 clones. The shortage of budwood arises from the decision to reduce the size of the plots from 100 to 30 trees, thus greatly increasing the number of clones to be tested.

Budding was carried out in the 53 plots and the results to date are shown in the attached table. The percentage of budding successes improved materially in the latter part of the year, the average for plots started since September being 54%. This figure represents the ratio of successes to total number of buds attached, and not the cumulative successes of two or more rounds of budding which is sometimes taken as the basis for calculating percentage successes on estates. Success in budding depends largely on the vigour of the stocks and the mediocre results at Nivitigalakele must be regarded as a corollary to the poor soil and slow growth of the plants in certain areas. Arrangements have been made for manuring all stocks which will be budded during 1931 so that they may be in a condition of active growth when the buds are applied.

Prolonged spells of dry weather in August and December resulted in a number of buds dying off between the first and second examination.

BUDWOOD NURSERY.

Rearrangement of the budwood nursery was undertaken by Mr. Pieris with a view to having each clone represented by 5-7 adjacent plants. Surplus plants and those in incorrect positions were cut down and the new shoots will be budded with other clones as required. Clones which are not yet represented by the correct number of plants will be completed during the next budding season.

Overgrown budded plants were pruned and a large number of unbudded plants were also cut back with a view to providing new shoots on which to bud when required.

SURVEY.

The Station was surveyed and a detailed plan (1 chain to an inch) prepared showing roads and paths, boundaries of clearings and the direction of rows of trees. Blank plans of each field on twice this scale were also obtained and it is intended to mark in the individual trees with details of stock and scion.

BUILDINGS, Etc.

A building comprising office and staff room with small kitchen and bathroom was erected. The building is constructed in cement bricks with iron roof. The staff room has been furnished and provided with a minimum of crockery and kitchen utensils so that an officer can reside there for a few days without inconvenience when important work is in progress.

At the invitation of the Executive Committee Mr. F. G. C. Busby undertook the planning and construction of a new bridge on the approach road to the Station, to replace the one which was undermined by floods earlier in the year. The new bridge, which is of massive construction, was opened for traffic early in January, 1931.

STAFF, LABOUR, Etc.

The Senior budder left in August and was replaced by Mr. H. J. Fernando. He has been given the title of budding conductor which is more in keeping with the work which he carries out.

The resident labour force at the end of the year consisted of 5 men, 4 women and 3 children. A further reduction is being made in view of the weeding being placed on contract.

RAINFALL.

	1930	1929
January ...	6.43 inches.	4.90 inches.
February ...	5.42 „	3.38 „
March ...	6.77 „	10.39 „
April ...	16.28 „	19.20 „
May ...	38.94 „	21.95 „
June ...	13.44 „	11.50 „
July ...	3.87 „	6.98 „
August ...	7.48 „	1.05 „
September ...	14.45 „	16.02 „
October ...	29.61 „	19.90 „
November ...	10.76 „	10.47 „
December ...	3.10 „	11.33 „
Total...	156.55 „	137.07 „

(Signed) T. E. H. O'BRIEN,
Chemist & Chief Technical Officer.

RUBBER RESEARCH LABORATORIES,
CULLODEN,
NEBODA.
5th. February, 1931.

BUDDING IN 1928 CLEARING.

(Including buds applied during December which were examined in January, 1931.)

Plot No.	Clone No.	Number of Plants.	Plants successfully budded.	Percentage completed.
1A	MK. 3/2	70	61	87
2A	MK. 1/1	71	17	24*
3A	KOS. 6	65	65	100
1	H. 24	27	27	100
2	WG. 6278	27	27	100
3	DK. 5315	25	25	100
4	H. 82	29	29	100
5	ST. G. 40	27	21	78
6	DBK. 1	25	25	100
7	MAD. 18	25	25	100
8	H. 140	25	21	84
9	PB. 25	26	26	100
10	DK. 19935	28	24	86
11	WP. 24	30	15	50*
12	PB. 23	26	11	42
13	Control	26	—	—
14	DK. 1.	26	26	100
15	WP. 57	30	9	30*
16	DBK. 4	30	30	100
17	WP. 76	27	7	26*
18	MAL. 44A	25	18	72
19	DK. 3513	26	26	100
20	ML. 1	27	27	100
21	ELST. 2313/16	25	4	16
22	NAK. 1	25	20	80
23	ELST. 2239/12	27	8	29
24	NAK. 3	28	19	68
25	ELST. 41/1	22	—	—*
26	NAK. 4	31	16	51
27	BS. 3.	34	20	59
28	MADD. 3741	27	24	89
29	TAL. 4	30	26	87
30	MAD. 22	27	11	41
31	COD. 3	30	13	43
32	HUN. 1391	25	7	28
33	COD. 4	26	13	50

* Further budwood not available until next season.

BUDDING IN 1928 CLEARING.--*Contd.*

(Concluding buds applied during December which were examined in January, 1931).

Plot No.	Clone No.	Number of Plants.	Plants successfully budded.	Percentage completed.
34	FR. 120	27	14	52
35	COD. 5	28	28	100
36	ST. G. 39	27	19	70
37	LBW. 37	26	25	96
38	MKV. 1	28	4	14
39	GL. 6	28	28	100
40	K. 1	27	25	92*
41	H. C. 28	28	28	100
42	K. 12	25	25	100
43	FR. 168	25	23	92*
44	K. 11	29	27	93*
45	RH. 9	30	15	50*
46	BP. 1	29	1	3*
47	RH. 10	26	23	88*
48	BP. 8	30	13	43*
49	RH. 15	27	6	22*
62	YOG. 11 T	26	26	100
64	YOG. 20 Y	27	12	44*
	Total (less plots 13 & 25).	1,545	1,085	70

* Further budwood not available until next season.

MYCOLOGIST'S REPORT FOR 1930.

1. MAJOR INVESTIGATIONS.

(*a*) **The Control of Oidium Leaf Disease** :—A large proportion of the time during the year under review has been spent in field experiments on the control of *Oidium*. Particular attention has been paid to the method of sulphur dusting which has proved very successful in Java. The supervision of these experiments on three mid-country estates has necessitated periodical absence from Culloden.

As stated in the Mycologist's Report for 1929 a number of plots were laid down in a badly affected field on Kandanuwara Estate, Matale, to investigate the possible value of manuring as a means of minimising the effects of *Oidium* attack. Calcium cyanamide and synthetic urea were used as sources of nitrogen, and muriate of potash as a source of potassium. The manures have been applied twice, viz. in January and December 1929. In April 1930 the plots were carefully inspected, the foliage of every individual tree being classified according to the degree of *Oidium* attack. No benefit due to the manures, as compared with control plots, was observed, and it would appear that manuring alone is unlikely to be of any value in the control of this leaf disease in badly affected areas. In areas where the defoliation due to *Oidium* is not severe the application of nitrogenous manures, may, however, be of value in minimising the effects of the disease. The applications of manure are being discontinued since the rubber is shortly to be cut out.

It was the intention to continue with the experiments on wet spraying with Sulfinette started in 1929, but after due consideration this method was abandoned and attention directed to sulphur dusting.

The first experiments on sulphur dusting were carried out on two adjoining estates in Matale, areas of 100 acres on Bandarapola and 30 acres on Kandanuwara being treated. The machine used was the Björklund Duster of Dutch manufacture ; the sulphur was the volcanic product from the Kawah Poetih volcano in Java. Both the machine and the sulphur proved very satisfactory.

On Bandarapola three applications of sulphur were made, a total quantity of about 34 lbs. per acre being applied. Although the dusted area showed an improved foliage as compared with an adjacent control field, the results were disappointing, and there is no doubt that the number of applications made was insufficient. Attention is drawn to the results obtained on Kandanuwara.

The experimental field of 30 acres was treated with five applications of volcanic sulphur at approximate fortnightly intervals from January 22 to March 12, a total quantity of about 53 lbs. per acre being applied. The foliage of the dusted field showed a marked improvement as compared with a neighbouring control area. A number of

photographs were taken to illustrate the dusting process and the results obtained, and these are reproduced in R. R. S. Quarterly Circular Vol. 7, Part 2, 1930.

As an additional means of judging the results of the dusting, the foliage of a number of individual trees in small plots scattered throughout the dusted and control fields was classified according to the intensity of *Oidium* attack. 156 trees were so examined in the dusted field, and 150 trees in the control field, the examination being made in April after the wintering was completed. In the dusted field 11% of the trees were classed as completely defoliated, while in the control area the figure was 53%. Correspondingly 20% were almost free from the disease in the dusted as against 3% in the undusted area. It is clear that although the fungicidal treatment was of great benefit, the disease was not completely controlled. Various reasons for this comparative lack of success have been adduced, and special attention will be paid to these points in future experiments. Yield records are being taken from a number of plots in the dusted and control fields, but no conclusions may yet be drawn. A further programme of dusting experiments on Kandanuwara has been arranged for 1931, and the operations were commenced in December 1930.

A series of experiments was undertaken on Kandanuwara to investigate the possibility of tea in the neighbourhood of dusted rubber being tainted by contact with the sulphur. A cloud of very finely divided sulphur cannot be entirely controlled, and in treating a field of rubber adjoining tea a small quantity of sulphur will inevitably fall on portions of the tea field. If this sulphur were to taint the manufactured tea a serious objection to the dusting process in tea-cum-rubber areas would be entertained.

The sulphur was applied from the dusting machine to a number of tea fields, the period between the time of dusting and plucking varying from a few hours to the full plucking cycle of 8 days. The quantity of sulphur applied was not more than 2 lbs. per acre, this being judged to be the maximum quantity that a field of tea adjacent to dusted rubber would receive provided that the operations were carried out with ordinary care. Although a smell of sulphur was usually noticeable during manufacture, in no case was there any taint in the made teas. The results were confirmed on several occasions, and it is concluded that in dusting rubber no fear need be entertained of tainting tea plucked in the immediate neighbourhood. Volcanic sulphur from Java was used; it is possible that these results do not apply to other forms of sulphur.

A further series of dusting experiments was carried out on Gonakelle Estate, Passara, the applications being made at fortnightly intervals from May 7 till August 20. A full report on these experiments is published in the Rubber Research Scheme Quarterly Circular Vol. 7, Part 4, 1930. Although the treatment, as judged by the general appearance of the dusted rubber, could not be considered highly successful a number of valuable conclusions could be drawn, of which the following are recapitulated:—

(1) " Flotate " volcanic sulphur from Java appears to be as effective a fungicide as the more specially prepared " Acme 300 " dust from America, and is preferable on account of its lower cost.

(2) In order that the dusting operations should achieve the maximum success they should be carried out during the period of refoliation after the normal "winter." The applications on Gonakelle were started too late in the year. It is probable that the first application should be made at the earliest appearance of young leaf after "wintering."

(3) The importance of ensuring that every portion of the rubber receives its full quota of sulphur is stressed. Steep land with few convenient paths may be very difficult and slow to dust effectively.

In conjunction with these experiments a dusting machine manufactured by Messrs. Drake & Fletcher Ltd., Maidstone, Kent, was fully tested and a report submitted, This trial machine was not entirely satisfactory, but it is understood that the modifications and alterations suggested are to be incorporated in an improved model.

A number of enquiries regarding the operation of sulphur dusting have been received from estates and agents, and several estates have been visited in this connection. It is probable that interest will be further stimulated when rubber sells at a more remunerative price. Sulphur dusting is undoubtedly a practical proposition on most estates in Ceylon, though with present methods it may be a slow and troublesome proceeding on steep land with few paths. There is no doubt that with further experience better results will be obtained.

At the Agricultural Conference held at Peradeniya in October 1930, a paper was read entitled "The Control of Oidium Leaf Disease."

(*b*) **Disinfection of Imported Budwood and Budded Stumps.**—Experiments have been carried out to find an effective and harmless method of disinfecting budwood and budded stumps with a view to guarding against the possible introduction of new diseases with imported material. Working with a strain of *Phytophthora palmivora*, which is suspected of having been introduced into Ceylon from Java in this way, the best results were obtained with a weak solution of copper sulphate. Soaking budwood in a 1% solution of copper sulphate for 5 minutes is found to be effective in killing any external *Phytophthora* infection. As regards the possible harmful effects of this treatment conflicting results have been obtained, and the matter is receiving careful attention. Tests have also been carried out with hydrocyanic acid gas and mercuric chloride. A memorandum was issued constituting an interim report of the work carried out and drawing attention to some of the practical considerations in connection with the application of any disinfectant treatment.

2. MISCELLANEOUS INVESTIGATIONS.

(*a*) **Disease of Bud-Shoots.**—The *Phytophthora* disease of bud-shoots mentioned in the Mycologist's report for 1929 has been further investigated, and an account was given in Rubber Research Scheme Quarterly Circular Vol. 7, Part 1. A considerable number of specimens of diseased shoots have been received, and it appears that more than one strain

of *Phytophthora palmivora* is associated with similar symptoms. Several strains have been isolated and are receiving investigation. Further observation has confirmed the conclusion that this disease is only to be feared in wet weather.

(*b*) **Bark Rot.**—An experiment was conducted during the S. W. Monsoon to test the relative merits of Cargilineum Mixture and Candarsan in the control of bark rot. Unfortunately, as in previous experiments, the incidence of bark rot was too slight to permit of reliable conclusions being drawn. It appeared that both the water-proof mixtures were effective in protecting the surface to which they were applied, but that they were of little or no value in protecting the more recently exposed cortex beneath. This confirms the opinion previously held.

As the result of correspondence with Mr. G. Martin, Superintendent of the London staff, a series of samples of special tar emulsions was prepared by the South Metropolitan Gas Company and forwarded for trial in Ceylon. Tests were carried out with these samples as bark rot disinfectants and a preliminary report has been submitted. The emulsions possess special properties which should render them particularly suitable for application to the tapping cut in the control of bark rot. The stability of the samples was not entirely satisfactory, however, and further tests will be conducted when more stable samples are received.

(*c*) **Xylaria Thwaitesii Root-Disease.**—A visit to an estate in the Kegalle district afforded an opportunity for a study of this uncommon root disease. A descriptive account was written for the Rubber Research Scheme Quarterly Circular Vol. 7, Part 3.

(*d*) **Watson's Tapping Process.**—An experiment was started in June on Culloden Estate, with the collaboration of the Superintendent, to test Sir Malcolm Watson's Patent Tapping Process to prevent losses of latex by rain. The process involves the application of an oily compound immediately beneath the tapping cut which prevents latex washing over the cut and down the trunk. Two inverted V cuts above the tapping panel are similarly treated with the Compo, and serve to divert the water flowing down the stem after rain. Two tapping tasks—400 trees—have been treated, and records are being kept of the amount of rubber brought in from these "vethus" and the hour at which they can be tapped, as compared with the two adjacent untreated "vethus". Seven months' records show an increased yield of about 12% which appears to be due to the treatment. Since the experiment is only roughly controlled it will be necessary to continue the yields for at least a further year before reliable conclusions may be drawn. There is no doubt, however, that the treatment hastens the drying of the tapping cut after rain and thus permits of earlier tapping. In the experiment the treated portions were tapped earlier than the control portions on 47 days out of 192, the average gain for these days being more than one hour.

3. ADVISORY WORK, Etc.

Visits were paid to 21 estates for advisory purposes, full reports being submitted to the superintendents and agents. The number of disease specimens and enquiries received from estates and agents amounted to 137. This represents a considerable increase as compared with 1929.

The total number of days spent away from the laboratories on Rubber Research Scheme work amounted to 116 as follows :—

Advisory visiting	29	days.
Sulphur dusting experiments	68	,,
Other experimental work	10	,,
Meetings and Agricultural Conference ...	9	,,
	116	

4. PUBLICATIONS.

(1) A Disease of Young Bud-shoots caused by *Phytophthora palmivora*, Butler. (Rubber Research Scheme Quarterly Circular Vol. 7, Part 1.)

(2) Sulphur Dusting as a Means of Controlling *Oidium*. (Leaflet No. 11, and Rubber Research Scheme Quarterly Circular Vol. 7, Part 2).

(3) The Control of Bark Rot (Leaflet No. 12).

(4) A Recent Outbreak of *Xylaria Thwaitesii* Root Disease. (Rubber Research Scheme Quarterly Circular Vol. 7, Part 3).

(5) Some Common Pests and Diseases of Young *Hevea* Buddings. (Rubber Research Scheme Quarterly Circular Vol. 7, Part 3).

(6) Proposals for Further Dusting Experiments against *Oidium* on Kandanuwara Estate, Matale. (Rubber Research Scheme Quarterly Circular Vol. 7, Part 3).

(7) The Control of *Oidium* Leaf Disease. (Paper read at Agricultural Conference. Rubber Research Scheme Quarterly Circular Vol. 7, Part 4).

(8) Report on Sulphur Dusting Experiments on Gonakelle Estate. (Rubber Research Scheme Quarterly Circular Vol. 7, Part 4).

(9) Diseases of Rubber in Ceylon. (To be published as a handbook).

(10) Diseases and Pests of Rubber 1930. (Annual Report of Kalutara Planters' Association).

R. K. S. MURRAY,
Mycologist.

RUBBER RESEARCH SCHEME LABORATORIES,
CULLODEN,
Neboda,
7th January, 1931.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR 1930.

The Committee and the Technical Sub-Committee each held four meetings during the year. A list of the members is given on page 4. A special Sub-Committee also attended a demonstration at Maidstone by Messrs. Drake and Fletcher of their spraying machine, which was subsequently forwarded to Ceylon for trial.

Mr. Bruce Foote (Ceylon Executive Committee) and Mr. L. Lord (Ceylon Technical Committee) attended meetings of the Committee whilst in London during the year, and Mr. C. E. A. Dias (Ceylon Executive Committee) and Mr. A. W. R. Joachim (Ceylon Technical Committee) visited the rubber research laboratories at the Imperial Institute and discussed with the staff the work carried out in London and various problems relating to rubber research.

Finance.—The expenditure incurred by the London Committee was £2646. 12. 5 which included £ 24. 11. 2 in respect of apparatus etc. purchased on behalf of the Ceylon Committee. At 31st December 1930, there was an unexpended balance in London of £49. 3. 11

Staff.—No alterations occurred in the technical staff which consists of Mr. G. Martin B. Sc., A. I. C., Mr. W. S. Davey, B. Sc., A. I .C., Mr. F. L. Elliott, F. I. C. and Mr. L. L. Stewart.

A report comparing methods of preparing plantation rubber in Ceylon, Malaya and Java compiled by Mr. Martin on his return from a visit to the East in 1929 was forwarded to Ceylon during the year, and published in the Fourth Quarterly Circular, 1930. The following are the principal questions raised in the report which, in the opinion of the Committee, are worthy of special attention by the rubber industry in the Colony, (1) the importance of keeping out of the latex fine particles of dirt which are too small to be removed by straining, (2) encouragement of bulking latex on a large scale with a view to securing greater uniformity, (3) the saving in cost to be derived from pressing sheet rubber in cases which hold about 220 lb. as is done in Java and Malaya. Enquiries made since have indicated that such an alteration would be welcomed by those handling raw rubber at the wharves in this country.

In a paper on the Evaluation of Raw Rubber read by Mr. Martin at a meeting of the Manchester and District Section of the Institution of the Rubber Industry in November the methods employed at the Imperial Institute for determining variability were fully described. This paper is to be published shortly in the Transactions of the Institution. During the course of the discussion attention was drawn to the importance of uniformity and also to differences in the type of raw rubber required for various manufacturing purposes. Endeavours are now being made by the Committee to obtain more exact information on the subject from manufacturers, with a view to considering whether any action can usefully be taken by rubber growers to supply a product which would not only be more satisfactory for the manufacturer's requirements but would lead to its wider industrial application.

Investigations.—During 1930 important progress was made with regard to the determination of the cause of variability in the plasticity of rubber. The principal headings under which the work has hitherto been carried out are, (1) development of methods of testing, (2) the effect of different methods of preparation and (3) the effect of different conditions of storage. The investigations in the first two sections have been practically completed, and were fully described in previous reports; those on the effect of storage will for obvious reasons take some considerable time but an examination of the results so far obtained and those of the previous work on methods of preparation has yielded definite information of great practical importance, viz. that the principal causes of the variation in plasticity are differences in the temperature and humidity conditions during storage, together with variations in the nature and (or) amount of substances in the rubber which retard oxidation.

By suitable treatment of the latex it should be possible to prepare either a very soft or a very hard rubber for both of which there is a definite demand. These recent experiments have thus opened up a new and important line of investigation on which, however, a very considerable amount of work would require to be carried out before practical recommendations for action on estates could be made. This work should prove of considerable economic value because first grade plantation rubber is often hard and difficult to manipulate in manufacturing operations. Consequently the demand is stimulated for reclaimed rubber and inferior grades which are mixed with first grade rubber to render it more suitable for manufacturing operations.

Attention was drawn in the report for 1929 to the advantages which would accrue if intrinsically uniform rubber could be readily marketed, as there is little doubt that supplies of such material would facilitate the existing uses of rubber and lead to extended applications. This view has recently received strong support as the result of the experience of the Propaganda Committee of the Rubber Growers' Association in endeavours to extend the use of rubber.

Extensive investigations with the object of improving the uniformity of Ceylon rubber were carried out in accordance with the programme outlined in last year's report. The first stage of the work to determine whether a satisfactorily uniform product could be obtained from individual estates in Ceylon was completed during 1930, and the results were sufficiently encouraging to justify proceeding with the second stage of the programme, viz. to determine whether any estates are producing abnormal types of rubber.

Preliminary experiments showed that the extent of the variability in village sheet may have an important bearing on the uniformity of Ceylon rubber as a whole, and the subject is being further studied. In the meantime the Committee suggested that it might be desirable to encourage small-holders to bring their latex to a factory working on co-operative lines.

As in previous years the staff in London co-operated with the Chemist in Ceylon in the examination of a number of samples received in connection with his investigations in the Colony.

Co-operation was continued with the Research Association of British Rubber Manufacturers in the investigation of, (1) the possibility of preparing ebonite with improved, properties and (2) the best forms of rubber for proofing kite balloon fabric.

The following reports were forwarded to Ceylon during the year:—

A Preliminary Investigation of the effect of different conditions of storage on the hardness of raw rubber (2nd Quarterly Circular, 1930).

The Effect of adding sodium bisulphite to latex on the plasticity of crepe (4th Quarterly Circular, 1930).

The Effect of maturation on the plasticity of smoked sheet and of paranitrophenol on maturation.

The Effect of different conditions of blanketing on the plasticity of crepe.

The Quality of village sheet.

The Ageing properties of sheet dried under different conditions.

The Cause of variability in the plasticity of plantation rubber after storage.

The Effect of curing sheet rubber over a coke fire.

The Effect of drying sheet rubber partially in air at 100° F and partially in smoke.

The Effect of drying sheet rubber partially at ordinary temperature and partially at 100° F.

The Effect of soaking freshly-creped coagulum in boiling water.

Crepe prepared by fractional coagulation.

Estate scrap rubber.

Value to rubber growers of the work in London of the Ceylon Rubber Research Scheme (Special Circular).

Reprint of paper by Mr. Davey on the influence of rubber resins in zinc-oxide-accelerator mixings, published in the Journal of the Society of Chemical Industry (Vol. 49, p. 338T).

Further information regarding the investigations is given in the appendix.

J. A. NELSON,
Secretary.

P. J. BURGESS,
Chairman.

IMPERIAL INSTITUTE,
LONDON, S. W. 7.
February, 1931.

APPENDIX TO THE ANNUAL REPORT OF THE LONDON COMMITTEE FOR 1930.

1. PLASTICITY.

(a) Effect of conditions of storage.

The results of recent experiments by the staff in London have shown why some rubbers are harder than others, and have indicated factors which require control in order to obtain rubber of uniform plasticity.

The experiments which led to these conclusions consisted in the storage of different forms of rubber under a variety of controlled conditions and so far the following facts have been established.

(1). Different forms of rubber harden in chemically inert gas such as dry nitrogen, apparently spontaneously. The higher the temperature up to 45°C the greater the amount of hardening which occurs in six months. At a temperature between 70°C and 140°C hardening ceases to occur and the rubber quickly becomes soft.

(2) Different forms of rubber harden less rapidly in dry oxygen than in dry nitrogen and in some cases the rubber becomes softer. The tendency to soften increases as the temperature of the rubber is raised, *e. g.* rubber which hardens at 15°C may become softer at 45°C.

(3) In a single experiment in air the degree of humidity was found to have a marked effect on the changes which occurred in the plasticity of rubber on storage. Further experiments are in progress to determine the effect of moisture over a range of temperatures in air and nitrogen respectively.

The results suggest that two factors are responsible for the changes which occur in the plasticity of rubber on keeping, viz: (1) a spontaneous hardening, (2) a softening due to oxidation. These factors operate simultaneously and the changes in the plasticity of the rubber during storage depend on their resultant effect.

These conclusions are in agreement with the experience of de Vries that rubber stored in Java sometimes becomes hard and sometimes soft, and also with the general experience at the Imperial Institute and of British manufacturers that rubber stored in Great Britain almost invariably increases in hardness. The difference in the behaviour of rubber in the two countries is probably due to the difference in temperature which, it has been shown, has a greater effect in increasing the softening due to oxidation than in increasing spontaneous hardening.

At present there is no evidence that samples of plantation rubber differ greatly in their rate of hardening in nitrogen at the same temperature.

Preliminary experiments indicate, however, that considerable variation occurs in the softening due to oxidation and that natural antioxidants in rubber have a marked effect in retarding softening. The latter fact explains the observation of de Vries in Java that rubber containing more than the usual amount of serum substances (and therefore of antioxidant) becomes hard on keeping, and rubber with less than the usual amount becomes soft.

The results of these experiments are obviously of great practical importance as regards the control of plasticity. By suitable treatment of the latex it should be possible to prepare either a very soft or a very hard type of rubber, for both of which there is a definite demand. The extent of hardening or softening would vary with the conditions of storage, but preliminary experiments indicate that the two types would retain their special characteristics when stored under ordinary conditions.

(b) Effect of Sodium bisulphite.

Experiments carried out during the year confirmed the previous conclusion that the addition of sodium bisulphite to latex increases the tendency of crepe to become hard on keeping, the rate of hardening being proportional to the amount of bisulphite used. As bisulphite is a strong reducing agent and should therefore retard oxidation its effect on plasticity is now explained by the results of the storage experiments referred to above.

Although the use of bisulphite increases the hardness of crepe, there is no evidence that it increases variability, and the effect on hardness is not sufficiently marked to warrant any modification of the present factory proceduro.

(c) Effect of maturation.

It was again confirmed that immersion of the coagulum in the serum for longer periods than is usual in estate practice has no effect on the plasticity of sheet. In the case of crepe a decrease in the plasticity occurred, but as suggested by Mr. O'Brien this difference is probably due to the use of bisulphite in crepe manufacture and not in sheet.

(d) Effect of different conditions of blanketing crepe.

As previous results were inconclusive a further set of samples was prepared to study the effect of temperature of rolling during blanketing on the plasticity of crepe. It was considered that blanketing has little effect on plasticity when the temperature of the rolls is kept low, but that it may have a marked effect if the rolls become hot. On the whole this agrees with the results of previous trials (Bulletin 49, p. 7). To obtain blanket crepe of uniform plasticity it is desirable that the blanketing rolls should be water-cooled.

2. THE UNIFORMITY OF PLANTATION RUBBER.

The first step in an attempt to produce uniform rubber throughout Ceylon is to ensure that the product of an individual estate will not vary throughout the year, and in order to study the extent of the variation which now occurs a series of monthly samples

of crepe and sheet from three estates in Ceylon was examined. The results showed that a satisfactorily uniform rubber can be obtained over a long period when the latex is always collected from the same group of trees, and the same methods of preparation are followed.

In view of the satisfactory results of the above investigation samples have been obtained from about 300 Ceylon estates in order to determine whether any of them are producing abnormal types of rubber, and then to investigate the methods of preparation with a view to improvement.

According to de Vries different consignments of rubber from a number of estates in Java show little variation in rate of vulcanisation in a rubber-sulphur mixing, and the investigation of a series of samples from a carefully controlled estate in Java supplied by the Proefstation voor Rubber at Buitenzorg confirms this conclusion.

A detailed report on the two investigations was in preparation at the close of the year. The results indicate that rubber is being prepared in Ceylon as uniform as that obtained from a carefully controlled estate in Java, but obviously no general conclusions can be drawn as to the extent of variability in estate rubber from either country.

Three samples of sheet rubber from different small holdings in Ceylon all had excellent mechanical and ageing properties, but their rates of vulcanisation in a rubber-sulphur mixing not only varied considerably but were widely different from those of sheet from the larger estates in Ceylon. The staff in Ceylon were accordingly asked to collect further samples so that a more detailed investigation may be made of the extent of the variability in village sheet, as this obviously has an important bearing on the question of uniformity of Ceylon rubber.

3.—CO-OPERATION IN EXPERIMENTS INITIATED BY Mr. O'BRIEN.

(a) Drying of Sheet Rubber.

In connection with Mr. O'Brien's preliminary investigation of the most economical method of drying sheet rubber, it was found at the Imperial Institute that sheet dried in air at 95° to 100°F had poor ageing properties in comparison with those of sheet dried in smoke. During the year under review a number of additional samples was prepared in order that a further comparison of the ageing properties of air-dried and smoked sheet might be made in London. It was invariably found that smoked sheet was superior to air-dried sheet, particularly when the sheet was dried in air at temperatures above 90°F. Modifications of the method of preparation were tried, including the addition of substances to the latex such as phenol, hydroquinone and/or formaldehyde, but in every case the ageing properties of the rubber were improved by exposure to smoke.

All the above air-dried sheet samples contained paranitrophenol to prevent the development of mould. Air-dried sheet samples without paranitrophenol examined in 1925 had excellent ageing properties and Mr. O'Brien suggests that this compound may have a harmful influence on air-dried sheet although previous work in London had shown that it has

no such influence on smoked sheet. This view has been confirmed by preliminary experiments and the investigation is being continued in 1931.

In view of the poor ageing properties of air-dried sheets containing paranitrophenol Mr. O'Brien carried out experiments on drying sheet in warm air in the presence of smoke produced by slow combustion of suitable material. Samples prepared in this way had excellent ageing properties, particularly one in which the smoke house was heated with a coke fire and smoke produced from coconut husks. Mr. O'Brien states that this method of smoking and drying has a considerable economic advantage over the usual procedure, and a consignment received for further laboratory tests and technical trials by manufacturers is under investigation.

(*b*). **Boiling the coagulum.**

Mr. O'Brien reported that in order to obtain a crepe of improved colour one estate made a practice of boiling the creped coagulum for ten minutes in water before passing through smooth rollers. At his suggestion samples were prepared by the estate superintendent by this method for examination in comparison with ordinary crepe in order to determine whether this procedure had any adverse effect on the properties of the rubber. It was found that the principal effect was a marked increase in plasticity and a reduction in the amount of acetone-soluble acids in the rubber.

As complaints are often made that plantation rubber is too hard, this method of softening the rubber is of considerable interest and is worthy of further study, particularly as the treatment was at one time employed to produce pale rubber, but has fallen into disuse since the introduction of bisulphite which, as stated above, causes the rubber to become hard.

The marked reduction in the amount of acetone-soluble acids in the rubber is difficult to explain, particularly as none of the other constituents appears to be affected. In consequence of this reduction the rubber gives poor results when vulcanised in certain accelerator mixings, but excellent results are obtained when one per cent. stearic acid is added Although the latter practice is adopted by manufacturers when using accelerated mixings it is still possible that in some mixings the deficient fatty acid content of the boiled rubber may lead to variability. Further investigation of the boiling treatment may suggest a method of preparing a plastic rubber which is not deficient in acetone-soluble acids.

4.—OTHER INVESTIGATIONS.

Arrangements were made with Mr. C. E. A. Dias when he visited the Imperial Institute to examine a sample of Up River Fine Para, obtained during his visit to the United States, which he had been informed was superior in quality to other varieties of fine hard Para and also to plantation rubber. Tests on the material showed that although it had excellent properties it was not superior to some samples of plantation rubber and fine hard Para previously examined at the Imperial Institute.

As arranged at the Conference of Rubber Technologists in Java in 1929, experiments were also carried out by an agreed method to determine whether the same results could be obtained in Java, Malaya and in London, with a view to standardising, if possible, rubber testing at the three research stations maintained by rubber planting organisations. The results of corresponding tests in Java and Malaya had not been received at the close of the year.

P. J. BURGESS,
Chairman.

J. A. NELSON,
Secretary.

IMPERIAL INSTITUTE,
LONDON, S. W. 7,

February, 1931.

APPENDIX A.

LIST OF MEMBERS.

Members of the Rubber Growers' Association.

Aboyne-Clyde Rubber Estates of Ceylon, Ltd.
Alliance Tea Company of Ceylon, Ltd.
Alluta Rubber and Produce Co., Ltd.
Amalgamated Tea Estates Co., Ltd.
Anglo-American Direct Tea Trading Co., Ltd.
Anglo-Ceylon and General Estates Co., Ltd.
Associated Tea Estates of Ceylon, Ltd.
Bandarapola Ceylon Co., Ltd.
Beau Sejor Rubber Co., Ltd.
Beverley Tea and Rubber Estates, Ltd.
Caledonian (Ceylon) Tea and Rubber Estates, Ltd.
Carolina Tea Company of Ceylon, Ltd.
Central Province Ceylon Tea Co., Ltd.
Ceylon (Bibile) Rubber Estates, Ltd.
Ceylon Consolidated Estates (1920), Ltd.
Ceylon (Para) Rubber Co., Ltd.
Ceylon Proprietary Tea Estates Co., Ltd.
Ceylon Planters' Rubber Syndicate, Ltd.
Ceylon Rubber Co., Ltd.
Ceylon Tea Plantations Co., Ltd.
Ceylon Timber and Rubber Syndicate, Ltd.
Colombo Commercial Co., Ltd.
Consolidated Estates Co., Ltd.
Consolidated Tea and Lands Co., Ltd.
Dalkeith (Ceylon) Rubber Estates, Ltd.
Dangan Rubber Estates, Ltd.
Deviturai Rubber and Tea Estates Co., Ltd.
Dickella (Ceylon) Rubber Estates, Ltd.
Dimbula Valley (Ceylon) Tea Co., Ltd.
Doloswella Rubber and Tea Estates, Ltd.
Doone Vale (Ceylon) Rubber Co., Ltd.
Doranakande Rubber Estates, Ltd.
Eastern Produce and Estates Co., Ltd.
East India and Ceylon Tea Co., Ltd.
Ederapolla Tea Co. of Ceylon, Ltd.
Elmshurst (Ceylon) Tea and Rubber Co., Ltd.
Elston Estates Company of Ceylon, Ltd.
Frocester Estate Rubber Co., Ltd.
Galaha Ceylon Tea Estates and Agency Co., Ltd.
Galphele Tea and Rubber Estates, Ltd.
General Ceylon Rubber and Tea Estates, Ltd.
Glen Rubber and Tea Co., Ltd.
Glendon Rubber Co., Ltd.
Gonagama Rubber Co., (Ceylon) Ltd.
Govinna Rubber Co., Ltd.
Grand Central (Ceylon) Rubber Estates Co., Ltd.
Hanipha Ceylon Tea and Rubber Co., Ltd.
Hanwella Rubber Estates, Ltd.
Hewagam Rubber Co., Ltd.
Higgoda Rubber Estates, Ltd.
Honiton Rubber Co., Ltd.
Hunasgeria Tea Co., Ltd.
Igalkande Rubber and Tea Estates, Ltd.
Imperial Ceylon Tea Estates, Ltd.
Kandy Rubber and Tea Estates, Ltd.
Kelani Valley Rubber Estates, Ltd.
Kepitigalla Rubber Estates, Ltd.
Kintyre Tea Estates Co., Ltd.
Knavesmire Estates Co., Ltd.
Kudaganga Rubber Co. of Ceylon, Ltd.
Kurunegala Rubber Co., Ltd.
Lanka Rubber Co., Ltd.
Lanka Plantations Co., Ltd.
Lavant Rubber and Tea Co., Ltd.
Lochnagar (Ceylon) Produce Co., Ltd.
Lowmont Estates Co., Ltd.
Lunuva (Ceylon) Tea & Rubber Co., Ltd.
Mahawale Rubber and Tea Co., Ltd.
Mapalagama Rubber Estates, Ltd.
Mirishena (Kalutara) Rubber Co., Ltd.
Monerakelle Rubber Estates, Ltd.
Nagolle (Ceylon) Rubber and Tea Plantations, Ltd.
Nahalma Tea Estates Co., Ltd.
Narangoda Rubber Co., Ltd.
Nayabedde Estates Co., Ltd.
Neboda (Ceylon) Rubber & Tea Estates, Ltd.

APPENDIX A.—*Contd.*

LIST OF MEMBERS

Members of the Rubber Growers' Association.

Ouvah (Ceylon) Estates, Ltd.
Panagula Rubber Co., Ltd.
Panawal Tea Co., Ltd.
Panawatte Tea and Rubber Estates, Ltd.
Pantiya Tea and Rubber Co., Ltd.
Parambe Rubber and Tea Co. of Ceylon, Ltd.
Pelmadulla Rubber Co., Ltd.
Pelmadulla Valley Tea and Rubber Co., Ltd.
Pimbura Rubber Co., Ltd.
Pindenioya Rubber and Tea Estates, Ltd.
Pitakande Tea Co. of Ceylon, Ltd.
P. P. K. (Ceylon) Rubber Estates, Ltd.
Ragalla Tea Estates. Ltd.
Remuna Rubber Co., Ltd.
Rosehaugh (Ceylon) Rubber Co., Ltd.
Rubber Estates of Bentota, Ltd.
Rubber Estates of Ceylon, Ltd.
Saffragam Rubber and Tea Co. of Ceylon, Ltd.
St. George Rubber Estates, Ltd.
Standard Tea Co. of Ceylon, Ltd.
Sunnygama Co., Ltd.
Telbedde (Ceylon) Estates, Ltd.
Tempo Tea and Rubber Co., Ltd.
United Planter's Co. of Ceylon, Ltd.
Vogan Tea Co. of Ceylon, Ltd.
Woodend (Kelani Valley, Ceylon) Rubber and Tea Co., Ltd.
Yataderiya Rubber and Tea Co., Ltd.
Yatiyantota (Ceylon) Tea Co., Ltd.

LOCAL SUBSCRIBERS.—(Companies).

Ambalawa Estate Co. of Ceylon, Ltd.
Ankande Estate Co. of Ceylon, Ltd.
Apthorpe Estates, Ltd.
Aranayaka Rubber Co., Ltd.
Atherfield Tea and Rubber Co., Ltd.
Avington Tea and Rubber Co., Ltd.
Ceylon Land and Produce Co., Ltd.
Clunes Estates Company of Ceylon, Ltd.
Cocoawatte (Ceylon) Rubber and Tea Estates, Ltd.
Colombo Commercial Co., Ltd.
Cullen Estates, Ltd.
Damblagolla Rubber Estates, Ltd.
Diwala (Kegalla) Rubber Co., Ltd.
Dorset Rubber Estate Co., Ltd.
Eila Tea Co., Ltd.
Estates Co. of Uva, Ltd.
Farnham Estate Co., Ltd.
Fernlands Tea Co., Ltd.
Gallebodda Estate Co. of Ceylon, Ltd.
Gallawatte (Ceylon) Rubber Co., Ltd.
Ganapalla Estate Co., Ltd.
Giragoda Rubber Co., Ltd.
Golinda Tea and Rubber Co., Ltd.
Hantane and Bollagalla Estates Co., Ltd.
Hatbawe Rubber Co., Ltd.
Haydella Tea and Rubber Estates, Ltd.
Hinwerelle Rubber Co., Ltd.
Horawala (Kalutara) Rubber Co., Ltd.
Hulandawa Rubber & Tea Co., (Ceylon)
Hunuwella (Pelmadulla) Rubber Co., Ltd.
Jambulande Tea and Rubber Estates, Ltd.
Kaluganga Valley Tea & Rubber Co., Ltd.
Kalutara Co., Ltd.
Kalutara Rubber Co. of Ceylon, Ltd.
Kandyan Hills Co., Ltd.
Karandupona Estates Co., Ltd.
Katiapola Rubber Co., Ltd.
Kelani Tea Garden Co., Ltd.
Kelani Valley Rubber Co. of Ceylon, Ltd.
Kinnersley (Kalutara) Rubber Co., Ltd.
Kiriella Estate Co., Ltd.
Kuttapitiya Tea and Rubber Co., Ltd.
Lagos (Ceylon) Rubber Co., Ltd.
Lansdowne Rubber Co., Ltd.
Lassahena Rubber Co., Ltd.
L. L. P. Estates, Ltd.
Lipton, Ltd.
Lunugala Tea and Rubber Co., Ltd.
Lyegrove Rubber Co., Ltd.
Macaldeniya Tea and Rubber Co., Ltd.
Mafalda Rubber Syndicate.
Mahagama Rubber Co., Ltd.
Meall Mor (Ceylon) Estates, Ltd.
Mocha Tea Co. of Ceylon, Ltd.
Moneragalla Rubber Co., Ltd.
Morakelle Rubber Co., Ltd.
Neuchatel Estates, Ltd.
Niriwatte Co., Ltd.
North Western Rubber Co., Ltd.
Opalgalla Tea and Rubber Estates, Ltd.
Opata Tea and Rubber Co., Ltd.
Panana (Kegalle) Rubber Co., Ltd.
Peacock and Nilambe (Ceylon) Tea and Rubber Estates, Ltd.
Piccadilly (Kelani Valley, Ceylon) Rubber and Tea Estates, Ltd.
Pine Hill Estates Co., Ltd.
Poonagalla Valley (Ceylon) Co., Ltd.
Ragama Tea and Rubber Co., Ltd.
Ratwatte Cocoa Co., Ltd.
Rayigam Co., Ltd.
Ruanwella Tea Co., Ltd.
Rubber Plantations of Kalutara, Ltd.
Rubber Securities, Ltd.
Ryan's Estates of (Ceylon,) Ltd.
Sheldon Estates, Ltd.
Sitawaka Tea and Rubber Co., Ltd.
Sunderland (Ceylon) Rubber Co., Ltd.
Syston Estates Co. of Ceylon, Ltd.
Tannahena Rubber Estates, Ltd.
Tillyfour Rubber Co., Ltd.
Udabage Tea and Rubber Co., Ltd.
Udagoda Tea and Rubber Co., Ltd.
Udakelle Rubber Co., Ltd., (*ceased* 1-7-30.)
Udapolla Rubber Co., Ltd.
Ullswater Rubber Co. of Ceylon, Ltd.
Usk Valley (Kalutara) Rubber Co., Ltd.
Uva Rubber Co. of Ceylon, Ltd.
Vauxhall Rubber Co., Ltd.
Vincit Tea and Rubber Co., Ltd.
Walakande Rubber Co., Ltd.
Walker, Sons & Co., Ltd.
Warriapolla Estates Co., Ltd.
Watapota Rubber and Tea Estates, Ltd.
Wellandura Tea and Rubber Co., Ltd.
Weniwella Rubber Co., Ltd.

LOCAL SUBSCRIBERS (INDIVIDUALS).

E. G. Adamaly & Co., ...	Alavi Estate.
C. E. A. Dias, Esq., J.P., ...	Mukalana and Wawulugala Estates.
The Rt. Hon. Lord Elphinstone, ...	Gikiyanakande Estate.
Sir H. M. Mallaby-Deely, Bart., ...	Ambanpitiya Estate.
Mackwoods, Ltd., ...	Guava Hill Estate.
Mackwoods, Ltd., ...	Cattarattenna, Hylton & Imboolpitiya Estates.
Mrs. A. S. Orchard, ...	Ilwana Estate.
Messrs. Wilmot A. and Leslie R. Perera,...	Hegalla Estate.
Lambert L. Pieris, Esq., ...	Bibilioyatenne Estate.
L. W. A. de Soysa, Esq., ...	Paradise and Nugahena Estates.
John H. Starey, Esq., ...	Tudugalla Estate.
A. Sykes, Esq., ...	Duhallow Estate.
W. W. Sevier, Esq., ...	Mousagalla Estate.

APPENDIX D.

RUBBER RESEARCH SCHEME (Ceylon).
ESTIMATES OF INCOME AND EXPENDITURE
FOR 1931.

REVENUE STATEMENT.

Income for 1931.

	Rs.	Cts.
Cess collections, ...	250,000	00
Rent of bungalows on Culloden ...	2,000	00
Interest	6,000	00
Sale of publications	1,000	00
Total Rs. ...	259,000	00

EXPENDITURE STATEMENT.

		Rs. Cts.	Rs. Cts.
1.	**Personal Emoluments.**		
	Salaries and wages	67,673 00	
			67,673 00
2.	**Laboratory.**		
	(*a*) Chemicals & Laboratory upkeep	1,750 00	
	(*b*) Apparatus from London	1,250 00	
	(*c*) Samples for Imperial Institute	500 00	
	(*d*) Dusting Experiments (Oidium)	800 00	
	(*e*) Routine tests on chemicals received from estates ...	200 00	
			4,500 00
3.	**Buildings.**		
	(*a*) Upkeep	1,500 00	
	(*b*) Insurances	315 00	
	(*c*) Upkeep of water supplies including pumping ...	500 00	
	(*d*) Upkeep of road to bungalows and laboratory ...	700 00	
	(*e*) Furniture replacements	400 00	
			3,415 00
4.	**Office.**		
	(*a*) Printing, Stationery & Advertising	3,000 00	
	(*b*) Postages	1,500 00	
	(*c*) Scientific Periodicals and Books	850 00	
	(*d*) General Charges	600 00	
	(*e*) Audit & Accountancy	500 00	
	(*f*) Furniture	1,000 00	
	(*g*) New Typewriter	350 00	
	(*h*) Telephones	335 00	
			8,135 00
5.	**Travelling.**		
	(*a*) Travelling expenses & subsistence allowance of staff	10,000 00	
	(*b*) Travelling expenses of members of the Board of Management	1,500 00	
	(*c*) Passages from England	3,500 00	
			15,000 00
6.	**Experiment Station.**		
	(*a*) Development & Upkeep	10,225 00	
	(*b*) Drainage and extension of budwood nursery and establishment of an instructional nursery ...	775 00	
			11,000 00
7.	**Special Charges.**		
	LONDON ADVISORY COMMITTEE'S EXPENDITURE.		
	(*a*) Salaries and Wages of Staff	£ 2,045	
	(*b*) Secretarial assistance	250	
	(*c*) Gas & Electric current	120	
	(*d*) Plant & Apparatus	140	
	(*e*) Miscellaneous & Contingencies	50	
		£ 2,605 = in	
	Ceylon Currency @ Rs. 13-50 to the £.	Rs. 35,167 00	
			35,167 00
8.	**Sinking Fund for Bonuses and Passages.**	10,000 00	
			10,000 00
		TOTAL Rs.	154,890 00

Summary.

	Rs.	Cts.
Estimated total income	259,000	00
Estimated expenditure during 1931	154,890	00
	Rs. 104,110	00
To be reserved as working capital	100,000	00
Estimated surplus at end of December, 1931 ... ... Rs.	4,110	00

These estimates were considered and approved at the meeting of the Board of Management held on December 5, 1930.

By Order,

JOS. I. GNANAMUTTU,
Secretary,
Board of Management.

Rubber Research Scheme (Ceylon),
Peradeniya,
4th March, 1931.

APPENDIX E.

CIRCULARS.

No.

1. Research Work in Ceylon (17-2-21).
2. Budding and Grafting of Rubber (2-9-21).
3. Research Work in Ceylon (5-9-21).
4. Scale of Subscriptions (27-2-22).
5. Research Work in Ceylon (1-7-22).
6. Rust and Mould on Sheet Rubber.
7. Research Work in Ceylon.
8. Shipment of Latex.
9. The Spraying of rubber trees as a means of control of secondary leaf-fall.
10. The Budding of rubber on a commercial scale.
11. Sulphur dusting as a means of controlling Oidium.
12. The Control of Bark Rot.
13. First Quarterly Circular for 1924.
14. Second Quarterly Circular for 1924.
15. Third Quarterly Circular for 1924.
16. Fourth Quarterly Circular for 1924.
17. First Quarterly Circular for 1925.
18. Second Quarterly Circular for 1925.
19. Third Quarterly Circular for 1925.

No.

20. Fourth Quarterly Circular for 1925.
21. First Quarterly Circular for 1926.
22. Second Quarterly Circular for 1926.
23. Third Quarterly Circular for 1926.
24. Fourth Quarterly Circular for 1926.
25. First Quarterly Circular for 1927.
26. Second Quarterly Circular for 1927.
27. Third Quarterly Circular for 1927.
28. Fourth Quarterly Circular for 1927.
29. First Quarterly Circular for 1928.
30. Second Quarterly Circular for 1928.
31. Third Quarterly Circular for 1928.
32. Fourth Quarterly Circular for 1928.
33. First Quarterly Circular for 1929.
34. Second Quarterly Circular for 1929.
35. Third Quarterly Circular for 1929.
36. Fourth Quarterly Circular for 1929.
37. Special Circular March 1930.
38. First Quarterly Circular for 1930.
39. Second Quarterly Circular for 1930.
40. Third Quarterly Circular for 1930.
41. Fourth Quarterly Circular for 1930.

APPENDIX F.

BULLETINS.

No. 1. The Effect of Tapping on the Movements of Plant-food in Hevea brasiliensis.
„ 2. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis. (continued).
„ 3. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part I.
„ 4. The Physiological Effects of Various Tapping Systems, Part I.
„ 5. Progress Report on Vulcanization Tests.
„ 6. The Physiological Effects of Various Tapping Systems, Part II.
„ 7. The Physiological Effects of Various Tapping Systems, Part III.
„ 8. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part II.
„ 9. Vulcanization Tests.
„ 10. Vulcanization Tests.
„ 11. Variability in Rubber Manufacture.
„ 12. Progress Report of the Rubber Research Chemist.
„ 13. Vulcanization Tests.
„ 14. On the Variation in the Number of Latex Vessels present in Hevea brasiliensis.
„ 15. Vulcanization Tests.
„ 16. On the Natural Clotting of Rubber Latex.
„ 17. Vulcanization Tests.
„ 18. Measurements of "Bark Renewal".

No. 19. Vulcanization Tests.
„ 20. Vulcanization Tests.
„ 21. Vulcanization Tests.
„ 22. Vulcanization Tests.
„ 23. Vulcanization Tests.
„ 24. Vulcanization Tests.
„ 25. Vulcanization Tests.
„ 26. Results of the Trials of Ceylon Rubber for the Manufacture of Ebonite.
„ 27. Vulcanization Tests
„ 28. Vulcanization Tests
„ 29. Summary of Results of Vulcanization Tests.
„ 30. The Penetration of Disinfectants on the Tapping Cut of Hevea.
„ 31. On the Occurrence of Rust on Sheet Rubber.
„ 32. On the "Preservation of Latex."
„ 33. Variability of Plantation Rubber, 1st Interim Report (New Series).
„ 34. Variability of Plantation Rubber, 2nd Interim Report (New Series).
„ 35. Variability of Plantation Rubber, 3rd Interim Report (New Series).
„ 36. Variability of Plantation Rubber, 4th Interim Report (New Series).
„ 37. Variability of Plantation Rubber, 5th Interim Report (New Series).
„ 38. Variability of Plantation Rubber, 6th Interim Report (New Series).
„ 39. Variability of Plantation Rubber, Final Report (New Series).
„ 40. Vulcanization and Mechanical Properties of Wet Rubber.
„ 41. First Interim Report on Artificial Ageing Tests on Plantation Rubber.
„ 42. On the Smoking of Sheet Rubber in Relation to Mould Prevention.
„ 43. The Inter-relationship of Yield and the various Vegetative Characters in Hevea brasiliensis.
„ 44. The Construction of Smoke-houses for Small Rubber Estates.
„ 45. The Efficiency of Disinfectants and Fungicides.
„ 46. The Control of Bark Rot by Disinfectants.
„ 47. On the Variability of Ceylon Estate Grades.
„ 48. Brown Bast and its Treatment.
„ 49. Causes of Variation in Plasticity.
„ 50. Crepe Rolling.
„ 51. The Curing of Sheet Rubber (in course of preparation).